Digitized by the Internet Archive
in 2013

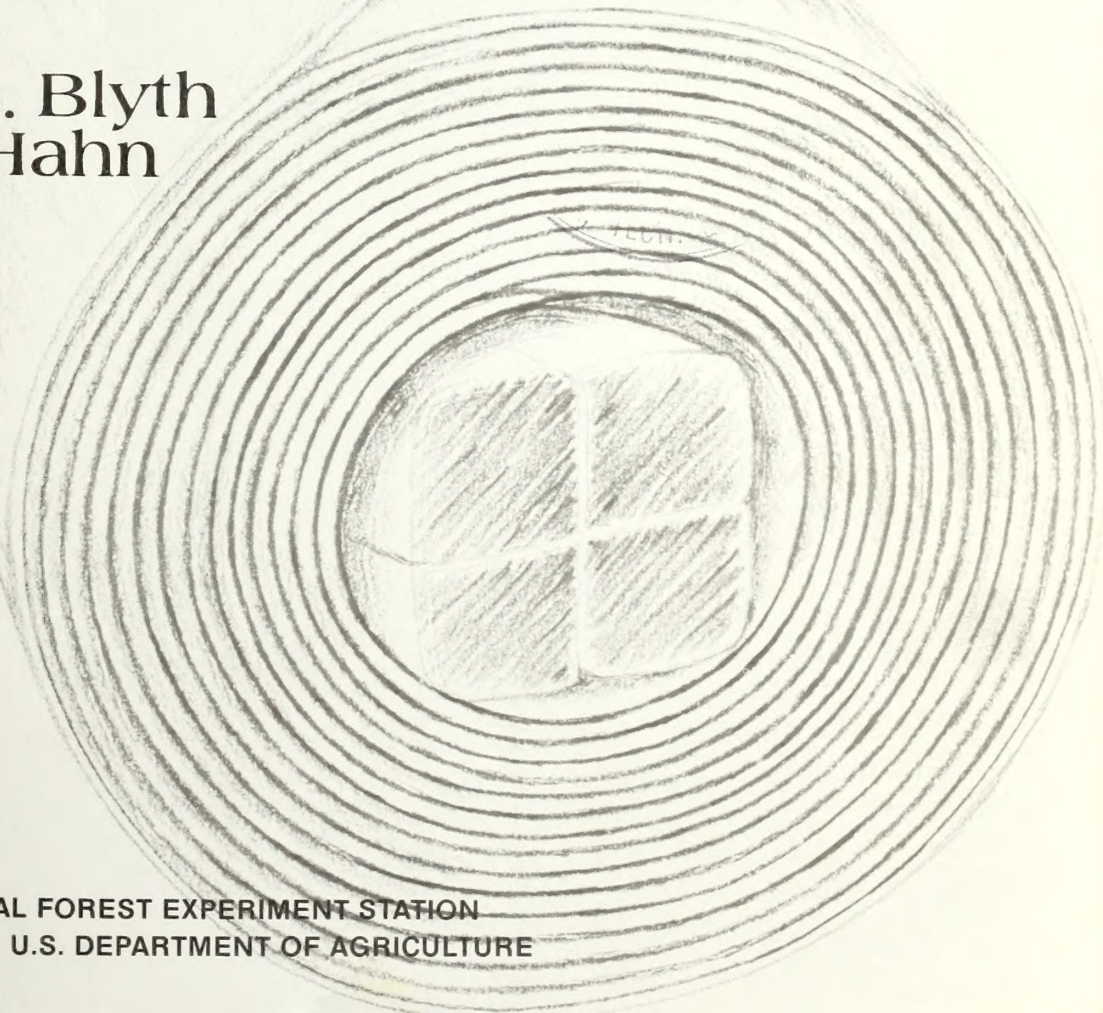
http://archive.org/details/resourcebulletin3650nort

USDA FOREST SERVICE
RESOURCE BULLETIN **NC-36**

VENEER - LOG PRODUCTION AND RECEIPTS, NORTH CENTRAL REGION 1976

GOVT. DOCUMENTS
DEPOSITORY ITEM
AUG 3 1978
CLEMSON
LIBRARY

James E. Blyth
Jerold T. Hahn



NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE • U.S. DEPARTMENT OF AGRICULTURE

North Central Forest Experiment Station
John H. Ohman, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication December 2, 1977
1978

SB63

HIGHLIGHTS

Lake States

In 1976 veneer log production was 69.6 million board feet, up 1 percent from 1974. Upward trends in production from hard maple, red oak, and elm continued. Log exports increased 19 percent from 1974 to 6.3 million board feet. Michigan outproduced Wisconsin for the first year recorded since 1956.

Veneer log receipts were off 2 percent from 1974 at 66.3 million board feet. Demand fell significantly for aspen and soft maple. Imports from Canada were only one-half million board feet.

Thirty-four percent of fine residue and 28 percent of the bark residue at veneer plants was not used and presents a disposal problem that may be alleviated by expanded use as industrial fuel.

Central States

Central States loggers harvested 27.4 million board feet of veneer logs in 1976, off 6 percent from 1974. White oak was the leading species harvested, displacing walnut for the first time recorded. Compared to 1974, exports rose 14 percent to 6.3 million board feet. Missouri may become a more important veneer log source if red and white oak continue to be favored species.

Compared to 1974, veneer logs receipts fell 9 percent to 36.1 million board feet. Imports of 15.0 million board feet came from 18 other states.

Disposal of wood and bark residue at mills is not a problem; only 6 percent of the wood and 7 percent of the bark was not used.

VENEER-LOG PRODUCTION AND RECEIPTS, NORTH CENTRAL REGION, 1976

James E. Blyth, *Principal Market Analyst*
and **Jerold T. Hahn**, *Mensurationist*

This report of 1976 veneer log production and receipts in the North Central Region is a continuation of a series begun more than 20 years ago. Veneer logs constitute the third most valuable roundwood product harvested (about $26 million F.O.B. mill) in the Region, outranked only by pulpwood and saw logs.

Current detailed veneer log production[1] and receipt information is necessary for intelligent planning and decisionmaking in wood procurment, forest resource management, and forest industry development. In addition, researchers need veneer log harvest and receipt information for planning projects and analyzing and appraising the veneer industry.

All but one veneer mill in the United States and Canada using North Central States timber reported their veneer log receipts in 1976 by species groups and State of origin. Their cooperation is gratefully acknowledged. Receipts were estimated for the nonresponding mill. Statistics for one large specialty veneer mill are excluded from this report to avoid disclosure of its operations (fig. 1). Data on logs exported to countries other than Canada are not shown.

All of the mills, except those in the northeast, were canvassed by this Station. A similar study by the Northeastern Forest Experiment Station provided data for veneer logs harvested in North Central States that were shipped to northeastern mills.

This report presents the results of the survey, analyzes and interprets the data where appropriate, compares results with 1974 or earlier years, and discusses trends in veneer log production and use. After a brief national overview, the report is divided into two sections—Lake States (Michigan, Minnesota, and Wisconsin) and Central States (Illinois, Indiana, Iowa, and Missouri)—because different species are grown and used as veneer logs in each area. Moreover, less information can be released about the Central States because more detailed data would reveal the operations of individual mills.

Fifty-six veneer mills operated in the Region in 1976; 38 were standard[2] veneer mills and 18 were container[3] veneer mills. Since 1974 two standard veneer mills closed (one in Wisconsin and one in Michigan), two merged in Indiana, and a large one began operating in Michigan. No container veneer mills completely ceased production, but two or three appear to be marginal operations.

---

[1] *Production is the volume of veneer logs cut from a specific area; receipts are the volume of veneer logs received by mills in a specific area regardless of geographic source.*

[2] *Commercial, face, and specialty veneer mills that manufacture veneer used in doors, furniture, wall panels, exterior sheathing, specialty plywood, and similar items.*

[3] *Mills that manufacture veneer used in boxes, crates, packing cases, and other wood veneer containers.*

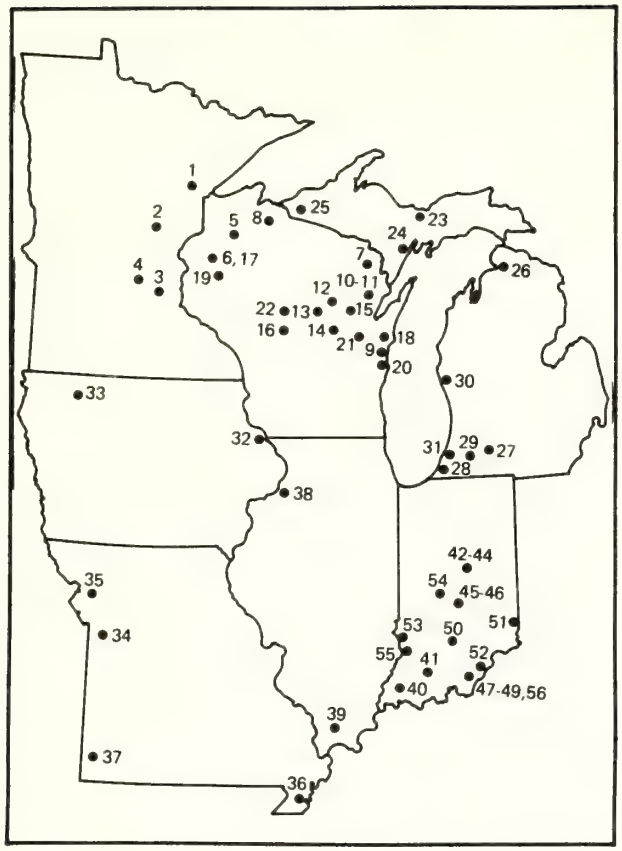


Figure 1.—*Location of active veneer mills in the North Central Region, 1976.*

NATIONAL OVERVIEW

Hardwood plywood production recovered in 1976 from 1975, but remained 11 percent below 1974 at 1.463 billion square feet[4] surface measure. Annual imports (for consumption) of hardwood plywood rose 44 percent between 1974 and 1976. Thus domestic manufacturers are facing severe competition from foreign sources.

Housing and furniture markets improved during 1976. Demand for high-grade veneers for furniture remained strong as walnut, red oak, pecan, maple, and cherry continued to dominate the market. However, veneer producers faced difficulties in marketing lower grade veneers because many furniture manufacturers switched from low-grade veneers for backs and drawer bottoms to prefabricated imports of these items or to hardboard or other materials.

[4]*Source: U.S. Department of Commerce, Bureau of the Census. Current Industrial Report Series MA-24F.*

Type of mill	Number	Name of mill	Location
		MINNESOTA	
Standard	1	Diamond International Co.[1]	Cloquet
	2	Wahkon Veneer Mills	Wahkon
Container	3	Allen Wood Products, Inc.	Hopkins
	4	Elk River Box Company	Elk River
		WISCONSIN	
Standard	5	Birchwood Lumber & Veneer Co.	Birchwood
	6	Birchwood Mfg. Co.	Rice Lake
	7	Louisiana-Pacific Corp.	Goodman
	8	Lousiiana-Pacific Corp.	Mellen
	9	Eggers Plywood Co.	Two Rivers
	10	Gillett Veneer & Plywood Co.	Gillett
	11	Linwood, Inc.	Gillett
	12	Wisconsin Timber & Land Co.	Matoon
	13	Hatley Veneer Co., Inc.	Hatley
	14	Marion Plywood Corp.	Marion
	15	Weber Veneer & Plywood Co.	Shawano
	16	Weyerhaeuser Co.	Marshfield
Container	17	Bruneete Box & Veneer	Rice Lake
	18	Dufeck Mfg. Co.	Denmark
	19	Ebner Box Factory	Cameron
	20	Konz Container Co.	Howard Grove
	21	Seymour Woodenware Co.	Seymour
	22	Standard Container Co.	Edgar
		MICHIGAN	
Standard	23	Cliffs Forest Products Co.	Munsing
	24	Anthony & Co.	Escanaba
	25	Iron Wood Products	Bessemer
	26	Manthei Bros.	Petosky
Container	27	A. C. Hensel Mfg. Co.	Augusta
	28	Anderson Container Co.	Stevensville
	29	Fruit Growers Package Co.	Paw Paw
	30	Michigan Crate & Basket	Shelby
	31	Riverside Package Co.	Riverside
		IOWA	
Standard	32	R. S. Bacon Veneer Co.	Dubuque
	33	Iowa Veneers, Inc.	Spencer
		MISSOURI	
Standard	34	Vario Veneer Corp.	Pleasant Hill
	35	Missouri Valley Walnut Co.	St. Joseph
Container	36	Betz Tipton Veneer Co.	Caruthersville
	37	Crumbliss Wood Products	Neosho
		ILLINOIS	
Standard	38	Swords Veneer & Lumber Co.	Rock Island
Container	39	The Martin Bros. Container & Timber Products, Inc.	Karnak
		INDIANA	
Standard	40	Evansville Veneer Co.	Evansville
	41	Jasper Veneer Mills	Jasper
	42	Central Veneer Co., Inc.	Indianapolis
	43	Curry Miller Veneers, Inc.	Indianapolis
	44	Indiana Veneers, Inc.	Indianapolis
	45	David R. Webb Co.	Edinburg
	46	Amos Hill Veneer Co.	Edinburg
	47	B. L. Curry & Sons	New Albany
	48	Chester B. Stem, Inc.	New Albany
	49	Adams Custom Veneer Co.	New Albany
	50	National Veneer & Lumber Co.	Seymour
	51	Pierson-Holowell Co., Inc.	Lawrenceburg
	52	Roberts & Strack Veneer Co.	Clarksville
	53	Ford Sawmill Inc. (Veneer Div.)	Vincennes
	54	Theising Veneer Co., Inc.	Mooresville
Container	55	Farrell Box Co., Inc.	Decker
	56	New Albany Box & Basket Co., Inc.	New Albany

[1]Receipts not recorded to avoid disclosure of operations at this mill.

Private housing starts were 1,540,000 units in 1976, a rise of 33 percent from the 29-year production low of 1975. Rising housing starts lead to better markets for veneer producers serving the wall paneling, kitchen cabinet, door, and furniture manufacturers.

Spending for home improvements has grown rapidly from about $12 billion in 1968 to nearly $30 billion in 1976. Popular items for the do-it-yourselfer have been two hardwood plywood products—prefinished wall paneling and laminated block flooring.

LAKE STATES

Production

Loggers harvested 69.6 million board feet of veneer logs in the Lake States in 1976, a gain of 900,000 board feet from 1974. More than 90 percent of the harvest was standard veneer logs; the rest was container veneer logs. Log markets strengthened in 1976 because the housing and furniture industries were recovering from low levels of production during 1974 and 1975. Many of the standard veneer mills sell veneer and plywood products to the housing and furniture suppliers and manufacturers.

Five species accounted for 85 percent of the total volume:

Species	Million board feet
Aspen	21.8
Hard maple	14.0
Red oak	11.8
Elm	6.7
Yellow birch	4.5

Recent upward trends continued in 1976 in hard maple, red oak, and elm veneer log production (fig. 2). Annual elm harvests are rising because high-quality logs are being salvaged from trees infected with Dutch Elm disease. Major changes in veneer log production between 1974 and 1976 were:

Species	Thousand board feet	Percent
Aspen	-2,432	-10
Hard maple	+2,312	+20
Soft maple	-967	-48

Log exports from the Lake States increased 19 percent from 1974 to 6.3 million board feet. Major export markets by volume were:

Destination	Thousand board feet
Indiana	2,618
Canada	2,425
Kentucky	614

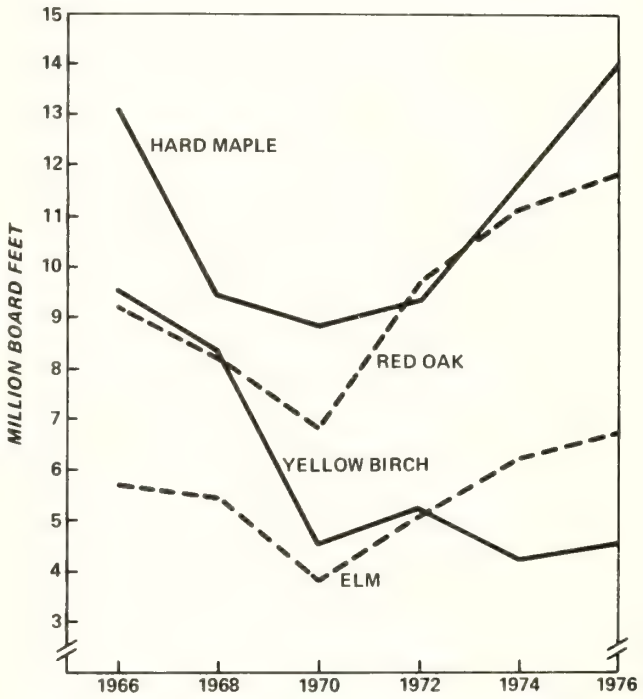


Figure 2.—*Veneer-log production of four major species for selected years, Lake States, 1966-1976.*

Michigan outproduced Wisconsin for the first recorded year since 1956 with a harvest of 33.4 million board feet. The new Michigan mill provided another important market for Michigan logs. Principal species cut were aspen and hard maple. Hard maple log production rose 2.5 million board feet above 1974. Wisconsin mills received 31 percent of the volume and 14 percent went outside the Lake States. Major species shipped out-of-state were hard maple, red oak, and yellow birch.

Wisconsin cut 31.7 million board feet of veneer logs, primarily aspen, red oak, elm, and hard maple. Aspen output fell 3.8 million board feet from 1974. Less than 4 percent of the harvest was

shipped outside the Lake States because of the large concentration of mills in and near Wisconsin.

Of the 4.6 million board feet of veneer logs produced in Minnesota, out-of-state mills procured 89 percent. Red oak, elm, and aspen were the primary species cut.

Mill Receipts

Veneer log receipts at Lake States mills fell 1.2 million board feet from 1974 to 66.3 million board feet in 1976. Demand dropped significantly for aspen and soft maple. Imports from Canada were one-half million board feet, down 76 percent from 1974. Import reductions from Canada were mainly hard maple and yellow birch.

Wisconsin veneer mills received 37.0 million board feet of veneer logs in 1976 compared with 41.6 million board feet in 1974. Major species procured were red oak, hard maple, elm, and yellow birch. Wisconsin forests supplied 56 percent of the volume, Michigan 28 percent, and Minnesota 8 percent. Nearly all (96 percent) of the imports to the Lake States from other States and Canada were shipped to Wisconsin.

Receipts rose in 1976 at nine Michigan mills to 28.8 million board feet from 25.3 million board feet in 1974. Aspen and hard maple accounted for 86 percent of the volume. Lake States forests furnished all the logs shipped to Michigan.

Minnesota's mills received 0.6 million board feet of veneer logs, unchanged from 1974.

Plant Residue[5]

As in 1974, more than 99 percent of the coarse residue generated at Lake States veneer mills was used. However, the use of the coarse residue changed because of the energy crisis. Coarse residue use for industrial fuel tripled between 1974 and 1976 while use of coarse residue for fiber products was halved. Meanwhile, use of fine residue for industrial fuel climbed to 58 percent of the total from 32 percent, and the same use of bark increased to 69 percent from 59 percent. The 34 percent of the fine residue and 28 percent of the bark not used has potential use as fuel.

[5]*Plant residue at veneer mills is classed as:* (1) *bark;* (2) *coarse (wood)—suitable for chipping, such as veneer cores;* (3) *fine (wood)—not suitable for chipping, such as veneer clippings.*

CENTRAL STATES

Production

Central States loggers cut 27.4 million board feet of veneer logs in 1976, off 6 percent since 1974 and about 10 million board feet less than a decade earlier (fig. 3). Of this total, 87 percent (23.8 million board feet) was standard veneer logs, and the remainder was used for container veneer.

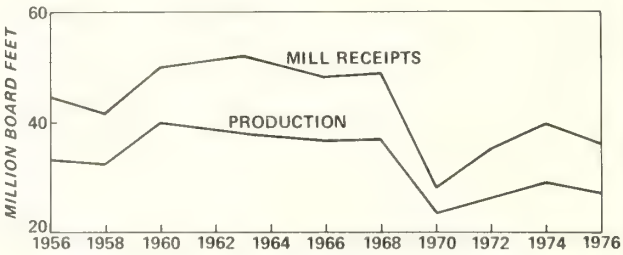


Figure 3.—*Veneer-log production and mill receipts in the Central States, 1956-1976.*

Major species cut were:

Species	Million board feet
White oak	7.7
Walnut	7.6
Red oak	3.8
Cottonwood	2.3

For the first time recorded, walnut was not the leading species harvested. White oak production advanced from only 1.7 million board feet cut in 1970 to the top position. Oak showed strong gains in importance for furniture in 1976. Red oak, also heavily used for furniture and cabinets, displaced cottonwood (used for containers) for third place in volume cut.

Principal harvest changes between 1974 and 1976 were:

Species	Thousands board feet
White oak	+2,516
Red Oak	+853
Cottonwood	-1,692
Walnut	-964

Exports moved 14 percent higher than in 1974 to 6.3 million board feet; primary buyers were in Kentucky (38 percent), Wisconsin (38 percent), and Ohio (9 percent).

Indiana supplied more than half (55 percent) of the Central States veneer log harvest. More than four-fifths of Indiana's production remained in the State. Iowa, the most lightly forested of the Central States, was the second-place producer, but relies heavily on Wisconsin markets for veneer logs. Missouri, heavily forested with oak, furnished only 10 percent of the veneer-log volume and only 8 percent of the oak harvest. If red and white oak continue to be favored veneer species, Missouri is likely to be a more important source of veneer logs.

Mill Receipts

Veneer log receipts dipped to 36.1 million board feet at 25 Central States mills in 1976 from 39.7 million board feet in 1974. Fifteen million board feet were imported from 18 other states representing all areas of the country except the far West. Ohio, Kentucky, Michigan, Oklahoma, and Pennsylvania each supplied more than one million board feet. Major imports included white oak from Ohio, pecan from Oklahoma, and hard maple from Michigan.

Indiana's 17 veneer mills received 83 percent of the total log receipts in 1976 including more than 90 percent of the pecan, black cherry, yellow-poplar, and hard maple.

Plant Residue

Disposal of wood and bark residue at mills is not a problem; only 6 percent of the wood and 7 percent of the bark was not used. Bark used increased from 70 percent in 1974 to 93 percent in 1976. Veneer mills burned nearly two-thirds of the residue as fuel. Other uses were for pulp manufacturing, mulch, and livestock bedding.

APPENDIX

Table 1.—*Production and imports of veneer logs, Lake States, 1976*
(In thousand board feet, International 1/4-inch log rule)

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS 2/
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S.	CANADA	TOTAL IMPORTS	
PINE								
MICHIGAN	0	0	108	108	0	0	0	108
WISCONSIN	106	0	188	294	0	0	0	294
TOTAL	106	0	296	402	0	0	0	402
ASH								
MICHIGAN	67	0	0	67	0	0	0	67
WISCONSIN	49	31	761	841	34	0	34	875
EXPORTED 3/	29	2	26	57	0	0	0	0
TOTAL	145	33	787	965	34	0	34	942
ASPEN								
MICHIGAN	10939	418	9614	20971	0	0	0	20971
MINNESOTA	0	0	6	6	0	0	0	6
WISCONSIN	18	0	465	483	0	0	0	483
EXPORTED 3/	0	368	0	368	0	0	0	0
TOTAL	10957	786	10085	21828	0	0	0	21460
BASSWOOD								
MICHIGAN	346	0	0	346	0	0	0	346
MINNESOTA	0	191	0	191	0	0	0	191
WISCONSIN	170	265	982	1417	300	0	300	1717
EXPORTED 3/	115	0	0	115	0	0	0	0
TOTAL	631	456	982	2069	300	0	300	2254
BEECH								
MICHIGAN	437	0	0	437	0	0	0	437
WISCONSIN	546	0	11	557	0	0	0	557
EXPORTED 3/	177	0	0	177	0	0	0	0
TOTAL	1160	0	11	1171	0	0	0	994
BLACK CHERRY								
MICHIGAN	92	0	0	92	0	0	0	92
WISCONSIN	21	0	66	87	11	0	11	98
EXPORTED 3/	66	0	0	66	0	0	0	0
TOTAL	179	0	66	245	11	0	11	190

TABLE 1 CONTINUED ON NEXT PAGE

TABLE 1 CONTINUED

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS 2/
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S.	CANADA	TOTAL IMPORTS	
BUTTERNUT								
WISCONSIN	0	0	14	14	0	0	0	14
EXPORTED 3/	1	0	184	185	0	0	0	0
TOTAL	1	0	198	199	0	0	0	14
COTTONWOOD								
MICHIGAN	559	0	0	559	0	0	0	559
MINNESOTA	0	43	0	43	0	0	0	43
WISCONSIN	0	83	749	832	0	0	0	832
TOTAL	559	126	749	1434	0	0	0	1434
ELM								
MICHIGAN	19	0	108	127	0	0	0	127
WISCONSIN	1108	628	4478	6214	3	0	3	6217
EXPORTED 3/	59	161	140	360	0	0	0	0
TOTAL	1186	789	4726	6701	3	0	3	6344
GUM								
MICHIGAN	6	0	0	6	0	0	0	6
TOTAL	6	0	0	6	0	0	0	6
HARD MAPLE								
MICHIGAN	3645	0	0	3645	0	0	0	3645
MINNESOTA	0	5	0	5	0	0	0	5
WISCONSIN	4835	186	3363	8384	122	234	356	8740
EXPORTED 3/	1968	0	16	1984	0	0	0	0
TOTAL	10448	191	3379	14018	122	234	356	12390
PAPER BIRCH								
MICHIGAN	625	0	0	625	0	0	0	625
WISCONSIN	207	137	255	599	0	85	85	684
EXPORTED 3/	0	12	0	12	0	0	0	0
TOTAL	832	149	255	1236	0	85	85	1309
PECAN								
EXPORTED 3/	49	0	7	56	0	0	0	0
TOTAL	49	0	7	56	0	0	0	0
RED OAK								
MICHIGAN	224	0	0	224	0	0	0	224
MINNESOTA	0	87	0	87	0	0	0	87
WISCONSIN	1201	1565	7232	9998	1746	0	1746	11744
EXPORTED 3/	1389	24	114	1527	0	0	0	0
TOTAL	2814	1676	7346	11836	1746	0	1746	12055

TABLE 1 CONTINUED ON NEXT PAGE

TABLE 1 CONTINUED

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS 2/
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S.	CANADA	TOTAL IMPORTS	
SOFT MAPLE								
MICHIGAN	248	0	0	248	0	0	0	248
MINNESOTA	0	42	26	108	133	0	133	241
WISCONSIN	130	42	514	686	184	0	184	870
EXPORTED 3/	7	0	0	7	0	0	0	0
TOTAL	385	124	540	1049	317	0	317	1359
SYCAMORE								
MICHIGAN	61	0	0	61	0	0	0	61
WISCONSIN	0	0	0	0	11	0	11	11
TOTAL	61	0	0	61	11	0	11	72
WALNUT								
EXPORTED 3/	169	9	531	709	0	0	0	0
TOTAL	169	9	531	709	0	0	0	0
WHITE OAK								
MICHIGAN	50	0	0	50	0	0	0	50
WISCONSIN	1	0	47	48	0	0	0	48
EXPORTED 3/	512	72	25	609	0	0	0	0
TOTAL	563	72	72	707	0	0	0	98
YELLOW BIRCH								
MICHIGAN	1028	0	0	1028	0	0	0	1028
WISCONSIN	1870	77	1464	3411	0	175	175	3586
EXPORTED 3/	35	0	0	35	0	0	0	0
TOTAL	2933	77	1464	4474	0	175	175	4614
YELLOW-POPLAR								
MICHIGAN	170	0	0	170	0	0	0	170
WISCONSIN	18	16	161	195	0	0	0	195
EXPORTED 3/	1	0	0	1	0	0	0	0
TOTAL	189	16	161	366	0	0	0	365
OTHER HARDWOODS								
WISCONSIN	0	3	2	5	1	0	1	6
EXPORTED 3/	0	52	28	80	0	0	0	0
TOTAL	0	55	30	85	1	0	1	6
ALL SPECIES								
MICHIGAN	18516	418	9830	28764	0	0	0	28764
MINNESOTA	0	408	32	440	133	0	133	573
WISCONSIN	10280	3033	20752	34065	2412	494	2906	36971
EXPORTED 3/	4577	700	1071	6348	0	0	0	0
TOTAL	33373	4559	31685	69617	2545	494	3039	66308

1/ VERTICAL COLUMNS OF FIGURES UNDER BOX HEADING PRODUCTION BY STATES PRESENT THE AMOUNT OF VENEER LOGS CUT IN EACH STATE.

2/ PRODUCTION MINUS EXPORTS PLUS IMPORTS.

3/ VENEER LOGS SHIPPED TO STATES OUTSIDE THE LAKE STATES AND TO CANADA.

Table 2.—*Mills using five species of Lake States veneer logs, by location, 1976*
(In numbers)

Location	Red oak	Hard maple	Yellow birch	Elm	Aspen
Lake States	16	15	9	15	9
Indiana	5	6	--	1	--
Illinois	1	1	--	1	--
Iowa	--	--	--	--	--
Ohio	--	1	--	--	--
Kentucky	1	1	--	1	--
Maryland	--	--	--	1	--
Canada	2	2	1	1	1
Total	25	26	10	20	10

Table 3.—*Veneer-log production and receipts in the Lake States by species, 1974 and 1976*

Species	Production			Receipts		
	1974	1976	change	1974	1976	change
Ash	752	979	+227	944	1236	+292
Basswood	263	316	+53	69	43	-26
Black cherry	198	135	-63	809	660	-149
Butternut	49	10	-39	274	194	-80
Cottonwood	3956	2264	-16992	5615	2584	-3031
Elm	664	42	-622	714	221	-493
Gum	1004	417	-587	1070	432	-638
Hard maple	1118	400	-718	1292	1364	+72
Pecan (hickory)	1166	975	-191	3618	4293	+675
Red oak	2944	3797	+853	3828	3068	-760
Soft maple	632	875	+243	670	560	-110
Sycamore	897	614	-283	1026	651	-375
Walnut	8518	7554	-964	10107	8264	-1843
White oak	5175	7691	+2516	7679	10821	+3142
Yellow-poplar	1225	1293	+68	1268	1393	+125
Other species	503	29	-474	748	304	-444
Total	29064	27391	-1673	39731	36088	-3643

Table 4.—*Veneer-log production by species group for selected years, Lake States, 1946-1976*

(In million board feet, International 1/4-inch log rule)

Year	Ash	Aspen	Bass-wood	Beech	Yellow birch	Cotton-wood	Elm	Hard maple	Soft maple	Red oak	White oak	Paper birch	Walnut	Other species	All species
1946	2.3	4.0	10.4	5.6	[1]26.8	0.4	16.6	[2]40.3	--	[3]3.1	--	--	--	1.1	110.6
1952	--	1.4	10.4	3.1	[1]18.2	--	11.5	[2]23.8	--	[3]5.1	--	--	--	[4]4.7	78.2
1954	.8	.3	9.2	3.2	[1]17.3	2.7	10.5	[2]20.9	--	[3]5.5	--	--	--	1.6	72.0
1956	.7	.8	10.3	5.7	[1]20.3	2.1	9.6	20.1	3.7	[3]4.5	--	--	.3	.9	79.0
1958	.6	1.7	7.1	1.8	[1]13.1	2.2	8.9	9.7	2.2	[3]4.8	--	--	.2	.4	52.7
1960	1.0	2.1	6.2	1.0	[1]14.1	1.9	5.1	10.9	2.9	[3]7.6	--	--	.6	.6	54.0
1963	.6	1.5	6.6	.3	[1]10.9	.4	5.7	10.5	2.2	[3]8.9	--	--	2.3	.6	50.5
1965	.7	.6	6.0	.5	[1]11.3	1.4	6.3	11.8	1.8	[3]9.0	--	--	.9	1.4	51.7
1966	1.1	.7	4.5	.5	[1] 9.5	1.4	5.7	13.1	1.5	9.1	.3	--	1.5	2.0	50.9
1968	1.0	.6	3.6	.5	8.3	1.4	5.4	9.4	1.2	8.2	.5	1.9	1.7	1.8	45.5
1970	.4	1.3	3.2	.3	4.4	1.3	3.8	8.8	.8	6.8	.3	1.2	.6	1.2	34.4
1972	.6	2.6	2.9	1.1	5.2	1.3	5.1	9.2	1.0	9.7	.3	1.2	1.4	.6	42.2
1974	.9	24.2	2.4	.7	4.2	1.8	6.1	11.7	2.0	11.1	.6	1.3	1.0	.7	68.7
1976	1.0	21.8	2.1	1.2	4.5	1.4	6.7	14.0	1.1	11.8	.7	1.2	.7	1.4	69.6

[1] Includes paper birch.
[2] Includes soft maple.
[3] Includes white oak.
[4] Includes ash and cottonwood.

Table 5.—*Veneer-log production for selected years and type of industry, Lake States, 1946-1976*

(In million board feet, International 1/4 log rule)

Year	Standard	Container	Total
1946	72.7	37.9	110.6
1948	71.7	45.1	116.8
1950	47.3	39.3	86.6
1952	46.8	31.4	78.2
1954	45.3	26.7	72.0
1956	51.6	27.4	79.0
1958	40.3	12.4	52.7
1960	46.5	7.5	54.0
1962	41.0	6.6	47.6
1963	43.9	6.6	50.5
1965	44.6	7.1	51.7
1966	45.0	5.9	50.9
1968	40.6	4.9	45.5
1970	29.4	5.0	34.4
1972	38.0	4.2	42.2
1974	64.1	4.6	68.7
1976	65.0	4.6	69.6

Table 6.—*Lake States veneer-log production, receipts, exports, and imports for selected years, 1946-1976*

(In million board feet, International 1/4-inch log rule)

Year	Produced in the Lake States and received at Lake States mills	Exported[1]	Imported[2]	Total production in Lake States	Total receipts in Lake States
1946	109.7	0.9	5.9	110.6	115.6
1948	116.0	.8	12.0	116.8	128.0
1950	86.0	.6	15.7	86.6	101.7
1952	77.8	.4	12.1	78.2	89.9
1954	71.6	.4	12.1	72.0	83.7
1956	78.7	.3	13.4	79.0	92.1
1958	51.5	1.2	6.0	52.7	57.5
1960	51.9	2.1	12.5	54.0	64.4
1963	45.0	5.5	7.7	50.5	52.7
1965	49.0	2.7	7.6	51.7	56.6
1966	45.8	5.1	9.6	50.9	55.4
1968	39.7	5.8	7.9	45.5	47.6
1970	31.4	3.0	5.6	34.4	37.0
1972	37.7	4.5	4.6	42.2	42.3
1974	63.4	5.3	4.1	68.7	67.5
1976	63.3	6.3	3.0	69.6	66.3

[1]From Lake States to other States and Canada.
[2]From other States and Canada into Lake States.

Table 7.—*Veneer-log receipts in the Lake States by species groups for selected years, 1952-1976*

(In million board feet, International 1/4-inch log rule)

Year	Ash	Aspen	Bass-wood	Beech	Yellow birch	Cotton-wood	Elm	Hard maple	Soft maple	Red oak	White oak	Paper birch	Other species	All species
1952	--	1.4	10.9	3.2	[1]27.1	--	11.7	[2]24.9	--	[3]5.3	--	--	[4]5.4	89.9
1954	.8	.3	10.3	3.2	[1]25.0	2.7	10.9	[2]22.4	--	[3]6.5	--	--	1.6	83.7
1956	.7	.8	10.6	5.7	[1]28.5	3.0	10.2	21.9	4.7	5.0	--	--	1.0	92.1
1958	.6	1.7	7.3	1.8	[1]17.2	2.2	9.2	9.6	2.5	5.0	--	--	.4	57.5
1960	1.1	2.1	6.8	.9	[1]18.9	3.3	6.2	12.2	3.6	8.4	--	--	.9	64.4
1963	.7	1.6	6.7	.3	[1]14.3	.7	4.9	11.1	2.6	9.3	--	--	.5	52.7
1965	.7	.6	6.3	.5	[1]14.5	2.1	6.3	13.2	1.9	9.3	--	--	1.2	56.6
1966	1.1	.7	4.8	.5	[1]14.7	2.3	5.8	12.8	1.8	9.7	.2	--	1.0	55.4
1968	1.0	.6	3.9	.5	10.2	2.1	5.2	9.0	1.3	8.3	.2	4.0	1.3	47.6
1970	.3	1.3	3.6	.3	6.1	1.4	3.8	9.0	.9	7.7	.2	1.9	.5	37.0
1972	.6	2.4	3.1	.7	6.3	1.3	5.3	9.4	1.2	10.1	.2	1.5	.2	42.3
1974	.9	24.3	2.6	.5	4.6	1.8	5.7	11.9	2.3	11.1	.1	1.3	.4	67.5
1976	.9	21.5	2.2	1.0	4.6	1.4	6.3	12.4	1.4	12.1	.1	1.3	1.1	66.3

[1]Includes paper birch.
[2]Includes soft maple.
[3]Includes white oak.
[4]Includes ash and cottonwood.

Table 8.—*Production and disposition of hardwood veneer plant residue by type of residue and use, Lake States, 1976*

(In thousand cubic feet)

State and type of use	Wood residue			Bark
	Total	Coarse[1]	Fine[2]	
Illinois, Iowa and Missouri				
Fiber products	32.0	32.0	--	--
Industrial fuel	221.3	49.9	171.4	103.4
Domestic fuel	7.4	7.4	--	.5
Miscellaneous[3]	19.7	19.7	--	13.1
Not used[4]	160.3	60.0	100.3	70.2
Total	440.7	169.0	271.7	187.2
Indiana				
Fiber products	342.3	149.3	193.0	--
Industrial fuel	1484.4	341.5	1142.9	738.7
Domestic fuel	3.5	3.5	--	--
Miscellaneous[3]	339.8	339.8	--	179.8
Not used[4]	4.4	--	4.4	5.1
Total	2174.4	834.41	1340.3	923.6
All Central States				
Fiber products	347.3	181.3	193.0	--
Industrial fuel	1705.7	391.4	1314.3	842.1
Domestic fuel	10.9	10.9	--	.5
Miscellaneous[3]	359.5	359.5	--	192.9
Not used[4]	164.7	60.0	104.7	75.3
Total	2615.1	1003.1	1612.0	1110.8

[1]Suitable for chipping, such as veneer cores.
[2]Not suitable for chipping, such as veneer clippings.
[3]Livestock bedding, mulch, small dimension and specialty items.
[4]Including residues burned as waste.

Table 9.—*Production and imports of veneer logs, Central States, 1976*

(In thousand board feet, International 1/4-inch log rule)

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/					IMPORTS			TOTAL RECEIPTS 2/
	ILLINOIS	INDIANA	IOWA	MISSOURI	REGIONAL TOTAL	LAKE STATES	OTHER U.S.	TOTAL IMPORTS	
PINE									
INDIANA	0	0	0	0	0	0	257	257	257
ILL.-IOWA-MO.	0	0	0	0	0	0	6	6	6
TOTAL	0	0	0	0	0	0	263	263	263
ASH									
INDIANA	18	469	0	0	487	0	295	295	782
ILL.-IOWA-MO.	11	38	284	23	356	27	71	98	454
EXPORTED 3/	0	102	34	0	136	0	0	0	0
TOTAL	29	609	318	23	979	27	366	393	1236
BASSWOOD									
INDIANA	0	15	0	0	15	27	0	27	42
ILL.-IOWA-MO.	0	0	1	0	1	0	0	0	1
EXPORTED 3/	0	0	300	0	300	0	0	0	0
TOTAL	0	15	301	0	316	27	0	27	43
BLACK CHERRY									
INDIANA	1	94	0	0	95	57	457	514	609
ILL.-IOWA-MO.	0	5	24	0	29	0	22	22	51
EXPORTED 3/	0	0	11	0	11	0	0	0	0
TOTAL	1	99	35	0	135	57	479	536	660
BUTTERNUT									
INDIANA	0	0	0	0	0	179	0	179	179
ILL.-IOWA-MO.	4	0	6	0	10	5	0	5	15
TOTAL	4	0	6	0	10	184	0	184	194
COTTONWOOD									
INDIANA	65	668	0	0	733	0	99	99	832
ILL.-IOWA-MO.	1421	0	0	110	1531	0	221	221	1752
TOTAL	1486	668	0	110	2264	0	320	320	2584
ELM									
INDIANA	0	2	8	0	10	73	0	73	83
ILL.-IOWA-MO.	7	0	21	0	28	110	0	110	138
EXPORTED 3/	0	1	3	0	4	0	0	0	0
TOTAL	7	3	32	0	42	183	0	183	221

TABLE 9 CONTINUED ON NEXT PAGE

TABLE 9 CONTINUED

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/					IMPORTS			TOTAL RECEIPTS 2/
	ILLINOIS	INDIANA	IOWA	MISSOURI	REGIONAL TOTAL	LAKE STATES	OTHER U.S.	TOTAL IMPORTS	
GUM									
INDIANA	2	386	0	0	388	0	41	41	429
ILL.,IOWA,MO.	3	0	0	0	3	0	0	0	3
EXPORTED 3/	19	0	0	7	26	0	0	0	0
TOTAL	24	386	0	7	417	0	41	41	432
HARD MAPLE									
INDIANA	0	265	0	0	265	998	57	1055	1320
ILL.,IOWA,MO.	4	7	1	0	12	32	0	32	44
EXPORTED 3/	0	1	122	0	123	0	0	0	0
TOTAL	4	273	123	0	400	1030	57	1087	1364
PECAN									
INDIANA	151	331	0	54	536	22	3364	3386	3922
ILL.,IOWA,MO.	4	5	271	91	371	0	0	0	371
EXPORTED 3/	8	18	0	42	68	0	0	0	0
TOTAL	163	354	271	187	975	22	3364	3386	4293
RED OAK									
INDIANA	42	1283	0	0	1325	682	667	1349	2674
ILL.,IOWA,MO.	35	40	279	2	356	33	5	38	394
EXPORTED 3/	144	360	1602	10	2116	0	0	0	0
TOTAL	221	1683	1881	12	3797	715	672	1387	3068
SOFT MAPLE									
INDIANA	44	265	0	0	309	0	20	20	329
ILL.,IOWA,MO.	231	0	0	0	231	0	0	0	231
EXPORTED 3/	17	1	264	53	335	0	0	0	0
TOTAL	292	266	264	53	875	0	20	20	560
SYCAMORE									
INDIANA	0	518	0	0	518	0	114	114	632
ILL.,IOWA,MO.	19	0	0	0	19	0	0	0	19
EXPORTED 3/	53	7	11	6	77	0	0	0	0
TOTAL	72	525	11	6	614	0	114	114	651
WALNUT									
INDIANA	654	2802	1481	362	5299	352	1379	1731	7030
ILL.,IOWA,MO.	97	5	279	452	833	102	299	401	1234
EXPORTED 3/	191	619	81	531	1422	0	0	0	0
TOTAL	942	3426	1841	1345	7554	454	1678	2132	8264
WHITE OAK									
INDIANA	1071	3962	0	38	5071	228	4225	4453	9524
ILL.,IOWA,MO.	178	152	75	587	992	12	293	305	1297
EXPORTED 3/	13	1314	59	242	1628	0	0	0	0
TOTAL	1262	5428	134	867	7691	240	4518	4758	10821

TABLE 9 CONTINUED ON NEXT PAGE

TABLE 9 CONTINUED

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/					IMPORTS			TOTAL RECEIPTS 2/
	ILLINOIS	INDIANA	IOWA	MISSOURI	REGIONAL TOTAL	LAKE STATES	OTHER U.S.	TOTAL IMPORTS	
YELLOW BIRCH									
INDIANA	0	1	0	0	1	0	0	0	1
TOTAL	0	1	0	0	1	0	0	0	1
YELLOW-POPLAR									
INDIANA	11	1237	0	0	1248	0	145	145	1393
EXPORTED 3/	15	5	0	25	45	0	0	0	0
TOTAL	26	1242	0	25	1293	0	145	145	1393
OTHER HARDWOODS									
INDIANA	0	2	0	0	2	0	4	4	6
ILL.,IOWA,MO.	0	0	0	0	0	0	34	34	34
EXPORTED 3/	0	0	26	0	26	0	0	0	0
TOTAL	0	2	26	0	28	0	38	38	40
ALL SPECIES									
INDIANA	2059	12300	1489	454	16302	2618	11124	13742	30044
ILL.,IOWA,MO.	2014	252	1241	1265	4772	321	951	1272	6044
EXPORTED 3/	460	2428	2513	916	6317	0	0	0	0
TOTAL	4533	14980	5243	2635	27391	2939	12075	15014	36088

1/ VERTICAL COLUMNS OF FIGURES UNDER BOX HEADING PRODUCTION BY STATES PRESENT THE AMOUNT OF VENEER LOGS CUT IN EACH STATE.
2/ PRODUCTION MINUS EXPORTS PLUS IMPORTS.
3/ VENEER LOGS SHIPPED TO STATES OUTSIDE THE CENTRAL STATES AND TO CANADA.

Table 10.—*Veneer-log production and receipts in the Central by species, 1974 and 1976*

(In thousand board feet, International 1/4-inch log rule)

Species	Production			Receipts		
	1974	1976	change	1974	1976	change
Ash	891	965	+74	861	942	+81
Aspen	24260	21828	-2432	24259	21460	-2799
Basswood	2387	2069	-318	2586	2254	-332
Beech	740	1171	+431	540	994	+454
Black cherry	74	245	+171	74	190	+116
Butternut	234	199	-35	11	14	+3
Cottonwood	1777	1434	-343	1774	1434	-340
Elm	6159	6701	+542	5677	6344	+667
Hard maple	11706	14018	+2312	11937	12390	+453
Paper birch	1277	1236	-41	1307	1309	+2
Pecan (hickory)	32	56	+24	1	--	-1
Red oak	11107	11836	+729	11098	12055	+957
Soft maple	2016	1049	-967	2313	1359	-954
Walnut	971	709	-262	--	--	--
White oak	561	707	+146	78	98	+20
Yellow birch	4172	4474	+302	4646	4614	-32
Other species	337	920	+583	327	851	+524
Total	68701	69617	+916	67489	66308	-1181

Table 11.—*Veneer-log production by species groups for selected years, Central States, 1956-1976*

(In million board feet, International 1/4-inch log rule)

Year	Cotton-wood	Elm	Hard maple	Pecan (hickory)	Red oak	Soft maple	Syca-more	Wal-nut	White oak	Yellow-poplar	Other species	All species
1956	8.0	0.9	0.8	0.1	1.1	1.8	0.6	10.6	3.4	1.6	4.2	33.1
1958	8.9	.6	1.1	.1	1.0	.5	.5	10.8	2.6	1.1	5.2	32.4
1960	11.2	2.0	1.2	.1	1.5	1.2	2.5	13.2	1.6	1.6	3.8	39.9
1963	7.4	.7	1.6	.8	.9	1.0	1.8	15.5	1.4	2.3	4.6	38.0
1966	6.2	1.7	1.4	1.1	2.3	.5	1.0	14.7	1.9	3.0	3.9	36.7
1968	4.1	.7	1.3	3.0	2.1	.4	1.2	16.1	3.6	1.3	3.2	37.0
1970	4.8	.6	.8	1.5	1.3	.5	1.3	8.1	1.7	.8	2.1	23.5
1972	3.5	.5	1.1	2.4	1.7	.4	.7	10.0	3.3	1.2	1.4	26.2
1974	4.0	.7	1.1	1.2	2.9	.6	.9	8.5	5.2	1.2	2.8	29.1
1976	2.3	(2)	.4	1.0	3.8	.9	.6	7.5	7.7	1.3	1.9	27.4

[1]Estimated.
[2]Less than 50 thousand board feet.

Table 12.—*Veneer-log receipts by species groups for selected years, Central States, 1956-1976*

(In million board feet, International 1/4-inch log rule)

Year	Cotton-wood	Elm	Hard maple	Pecan (hickory)	Red oak	Soft maple	Syca-more	Wal-nut	White oak	Yellow-poplar	Other species	All species
1956	10.9	0.8	1.2	0.6	1.3	0.8	1.3	11.4	6.7	2.8	6.6	44.4
1958	10.2	.6	1.7	.3	1.3	.3	1.2	13.0	4.8	1.9	6.3	41.6
1960	10.4	1.0	2.9	.2	1.4	.5	2.3	17.1	3.6	2.8	8.0	50.2
1963	8.6	1.0	3.1	1.6	.9	.8	2.0	21.2	2.3	2.8	7.9	52.2
1966	6.7	[1]1.0	3.6	1.6	2.0	.4	1.2	17.9	2.1	4.4	7.3	48.2
1968	5.7	1.0	2.7	4.9	2.3	.5	1.1	18.4	5.2	1.9	5.1	48.8
1970	4.7	.5	1.3	3.0	.8	.6	1.4	10.0	2.0	1.1	2.6	28.0
1972	4.9	.3	2.4	5.7	1.6	.5	.9	11.0	4.0	1.2	2.6	35.1
1974	5.6	.7	1.3	3.6	3.8	.7	1.0	10.1	7.7	1.3	3.9	39.7
1976	2.6	.2	1.4	4.3	3.1	.5	.6	8.3	10.8	1.4	2.9	36.1

[1]Estimated.

Table 13.—*Production and disposition of hardwood veneer plant residue by type of residue and use, Central States, 1976*

(In thousand cubic feet)

State and type of use	Wood residue			Bark
	Total	Coarse[1]	Fine[2]	
Michigan				
Fiber products	439.5	420.9	18.6	12.8
Industrial fuel	272.9	20.0	252.9	317.6
Domestic fuel	43.8	16.8	27.0	18.6
Miscellaneous[3]	332.9	332.9	--	-
Not used[4]	1002.8	11.8	991.0	539.4
Total	2091.9	802.4	1289.5	888.4
Minnesota				
Industrial fuel	4.4	2.8	1.6	3.6
Domestic fuel	11.4	11.4	--	9.9
Miscellaneous[3]	3.6	1.8	1.8	--
Not used[4]	22.3	--	22.3	4.2
Total	41.7	16.0	25.7	17.7
Wisconsin				
Fiber products	319.5	236.9	82.6	--
Industrial fuel	2115.9	641.6	1474.3	1094.1
Domestic fuel	29.5	29.5	--	--
Miscellaneous[3]	212.2	119.1	93.1	7.5
Not used[4]	.8	.3	.5	35.2
Total	2677.9	1027.4	1650.5	1136.8
All Lake States				
Fiber products	759.0	657.8	101.2	12.8
Industrial fuel	2393.2	664.4	1728.8	1415.3
Domestic fuel	84.7	57.7	27.0	28.5
Miscellaneous[3]	548.7	453.8	94.9	7.5
Not used[4]	1025.9	12.1	1013.8	578.8
Total	4811.5	1845.8	2965.7	2042.9

[1]Suitable for chipping, such as veneer cores.
[2]Not suitable for chipping, such as veneer clippings.
[3]Livestock bedding, mulch, small dimension and specialty items.
[4]Including residues burned as waste.

☆U. S. GOVERNMENT PRINTING OFFICE: 1978—768-448/13 REGION NO. 6

Blyth, James E., and Jerold T. Hahn.
1978. Veneer-log production and receipts, North Central Region, 1976. U.S. Dep. Agric. For. Serv. Resour. Bull. NC-36, 17 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Shows 1976 veneer-log production and receipts by species in the Lake States (Michigan, Minnesota, and Wisconsin) and in the Central States (Illinois, Indiana, Iowa, and Missouri). Comparisons are made with similar data for 1974. Includes tables showing veneer-log production and receipts (for selected years) since 1946 in the Lake States and since 1956 in the Central States.

OXFORD: 832.20:792(77). KEY WORDS: imports, exports, veneer mills, wood residue, bark.

Blyth, James E., and Jerold T. Hahn.
1978. Veneer-log production and receipts, North Central Region, 1976. U.S. Dept. Agric. For. Serv. Resour. Bull. NC-36, 17 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Shows 1976 veneer-log production and receipts by species in the Lake States (Michigan, Minnesota, and Wisconsin) and in the Central States (Illinois, Indiana, Iowa, and Missouri). Comparisons are made with similar data for 1974. Includes tables showing veneer-log production and receipts (for selected years) since 1946 in the Lake States and since 1956 in the Central States.

OXFORD: 832.20:792(77). KEY WORDS: imports, exports, veneer mills, wood residue, bark.

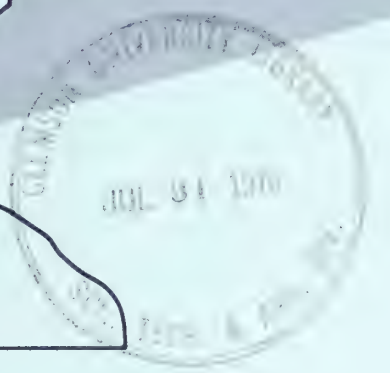
People need fish...fish and

people need clean water.

SDA FOREST SERVICE
ESOURCE BULLETIN **NC-37**

Minnesota's Tax-forfeited Land:

GOVT. DOCUMENTS
DEPOSITORY ITEM
JUL 31 1990
CLEMSON
LIBRARY



JUL 31 1990

Some TRENDS in acreages, sales, and prices

David C. Lothner
Edwin Kallio
David T. Davis

orth Central Forest Experiment Station
orest Service, U.S. Department of Agriculture

The authors wish to thank the individual county land commissioners and auditors, the Office of Iron Range Resources and Rehabilitation, and the Minnesota Department of Natural Resources for their cooperation.

North Central Forest Experiment Station
John H. Ohman, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication December 16, 1977
1978

MINNESOTA'S TAX-FORFEITED LAND: SOME TRENDS IN ACREAGES, SALES, AND PRICES

David C. Lothner, *Economist,*
Edwin Kallio, *Principal Market Analyst,*
and **David T. Davis,** *Supervisory Technician,*
Duluth, Minnesota

The demand for timber from all public and private land in northern Minnesota is increasing and is likely to continue to increase in the future. At the same time, the demand for recreation and other forest-based resources has also increased. Thus, land use conflicts have grown and are likely to continue to grow. Because county-administered, tax-forfeited land is important for supplying a variety of forest-based resources, changes within the county-administered land base could greatly affect the total available supply of timber and other forest-based resources in Minnesota. Therefore, we compiled the data on tax-forfeited land sales, prices, and acreages from 1960 to 1974 to see what changes or trends are occuring in this important resource.[1]

This land, although commonly referred to as county land, is actually State land held in trust for the county governments. The land was once privately owned and went tax delinquent when the owners failed to pay the property taxes. Thus, it eventually forfeited back to the State, which gave the provision for its management to the counties. And, it is the counties that receive most of the revenue generated from its use or sale. Most tax-forfeited acreage in Minnesota is located in the 16 northern Minnesota counties (fig. 1). Much of this area is or once was forested.

[1]*Statistics are based on data from county offices, the Minnesota Department of Iron Range Resources and Rehabilitation, and the Minnesota Department of Natural Resources.*

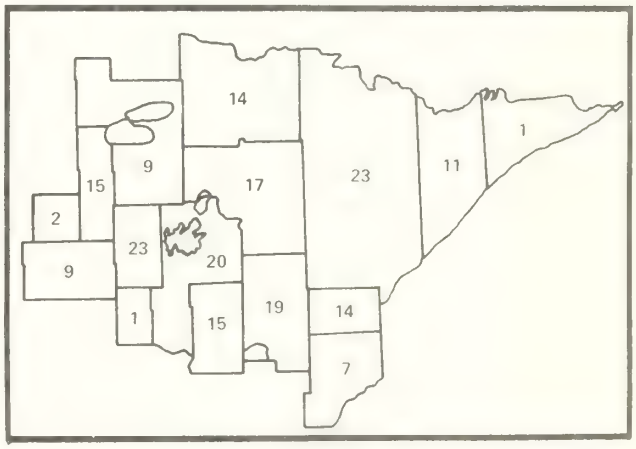


Figure 1.—*Percent of the total county land area administered as tax-forfeited land in northern Minnesota, 1974.*

SOME SIGNIFICANT TRENDS

The total tax-forfeited acreage in the 16 northern Minnesota counties decreased from about 3.5 million acres in the mid-1960's to slightly less than 2.9 million acres in 1974, which is about a 17 percent decrease (fig. 2). This decrease is due to changes in three major factors—land sales, land forfeitures, and land exchanges and transfers.

Acreage sold by all counties remained stable throughout the 1960's then began to decrease significantly in the 1970's (fig. 3). Zoning, land classification, mineral potentials, and a changing

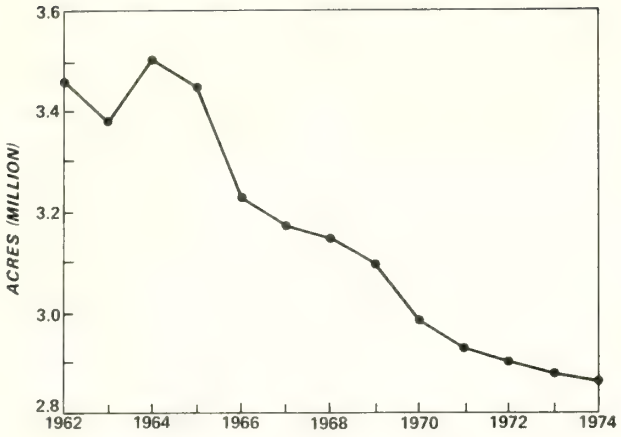


Figure 2.—*Total tax-forfeited acres in northern Minnesota counties, 1962 to 1974.*

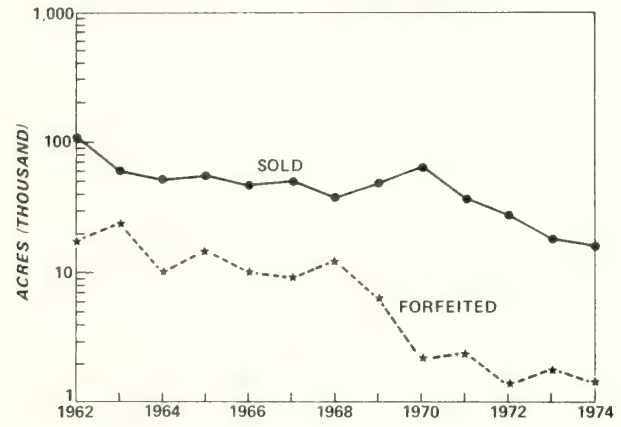


Figure 3.—*Total tax-forfeited acres sold by and acres forfeited to northern Minnesota counties (excludes St. Louis County).*

attitude by the public on implicit values of land in public ownership had a significant effect in reducing sales in the 1970's. A change in State law that prohibits the sale of tax-forfeited land with water also had an impact in certain counties.

The total of land forfeitures for all counties remained considerably less than land sales. It decreased slightly through the 1960's and then decreased drastically in all counties except St. Louis County in the 1970's (fig. 3).

A small amount of tax-forfeited acreage has been exchanged with private parties and the federal government. Sizable acreage has been transferred from county to State administration. Under this transfer, the State DNR is responsible for management planning and administration, but 50 percent of the revenue generated from the management of these transferred lands is returned to the county governments for their use.

Although the acreage sold by the counties decreased each year, the value of the land sold increased dramatically. The average price per acre (including both land and timber) increased from $6.33/acre in 1960 to nearly $70/acre in 1974 as determined from regularly scheduled land sale records (fig. 4). This was an average yearly rate of increase of almost 19 percent. Since 1970, the average rate of increase was even greater—almost 39 percent per year.

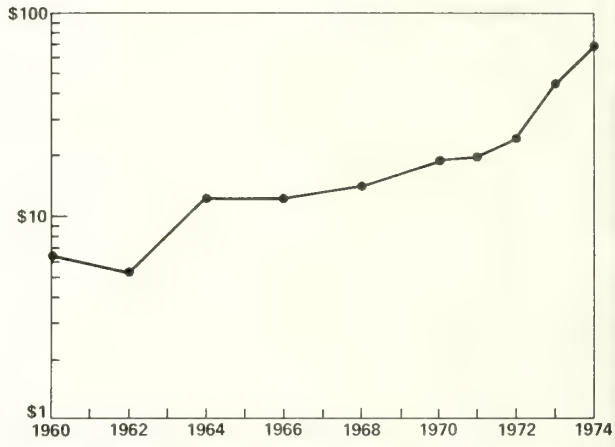


Figure 4.—*Average selling price per acre of tax-forfeited land sold through regularly scheduled land sales in Minnesota, 1960 to 1974 (excludes St. Louis County.).*

Land that appreciates at a 19 percent rate doubles its value in about 4 years. If this rate of increase continues, land valued at $70 per acre in 1974 would be worth $475 per acre in 1985, and $6,450 per acre in 2000.

The price of the land sold has varied greatly, depending upon the raw productive capacity, level of renewable resources presently associated with the land, expected land use, location, etc. Therefore, a wide range in selling price is often experienced in county land sales of even adjacent parcels.

During the early 1960's, much of the land placed on the auction sales list was purchased at the appraised price with little or no active bidding. In many counties, a number of parcels did not sell during one sale and were carried over to the next sale list. Those days appear to be over, at least for the immediate future. Although the number of nonplatted parcels placed up for auction have been reduced during the period, the active bidding has increased considerably above the appraised selling price.

SOME INDIVIDUAL COUNTY TRENDS

The counties vary considerably in the amount of tax-forfeited land they administered in 1974 (fig. 5). St. Louis County administered by far the largest share of total tax-forfeited land—33 per cent. Five counties—St. Louis, Itasca, Koochiching, Cass, and Aitkin—managed nearly 70 percent of the total tax-forfeited acreage in 1974.

Although the patterns vary by county, there have been significant reductions in tax-forfeited acreage in several counties. Counties with the largest relative reductions for the 1960 to 1974 period are Wadena, Mahnomen, Pine, Cook, and Itasca (fig. 6). In addition to large land sales, Wadena, Mahnomen, and Pine Counties have also transferred significant acreage to the State under the revenue sharing arrangement mentioned earlier.

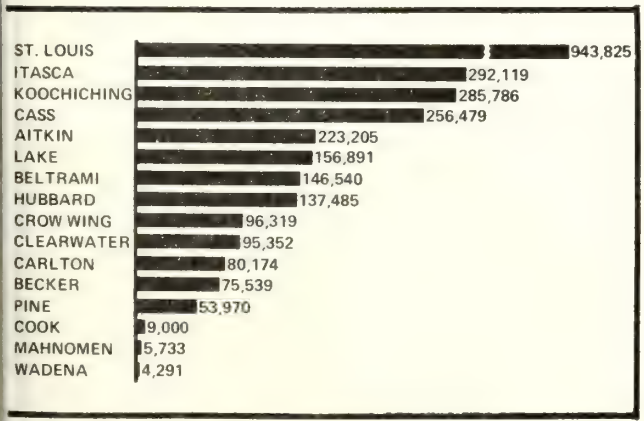


Figure 5.—*Tax-forfeited acreage by county, 1974.*

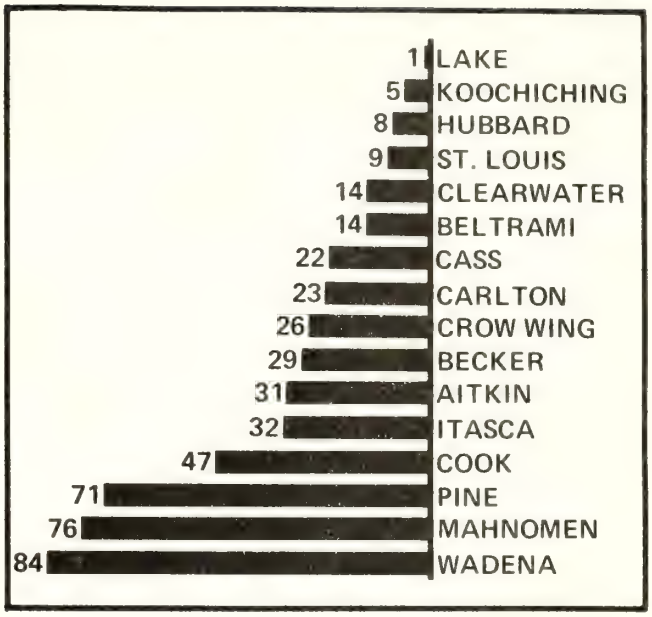


Figure 6.—*Percent decrease from 1960 to 1974 in tax-forfeited acreage by county.*

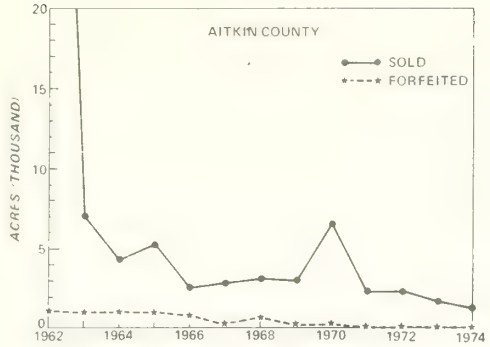
All of the 16 northern Minnesota counties sold more land than was forfeited to them (fig. 7). One-half of the 16 counties (Becker, Beltrami, Carlton, Cass, Clearwater, Cook, Koochiching, and Wadena) maintained a consistent selling rate throughout the 1960's. Although there was a year-to-year variation, there is little discernable trend. All of these counties except Koochiching witnessed a reduction in acres sold each year in the 1970's. Koochiching County had a significant increase in acreage sold in 1974 because 2,142 acres were sold for the development of Voyaguers National Park.

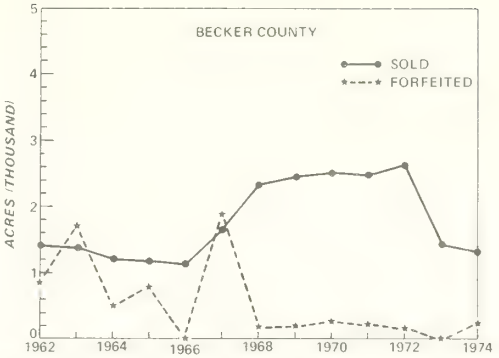
The amount of land sold in Aitkin, Hubbard, and Lake Counties decreased each year from 1962 to 1974. In fact, Lake County offered no land for sale from 1964 through 1974.[2]

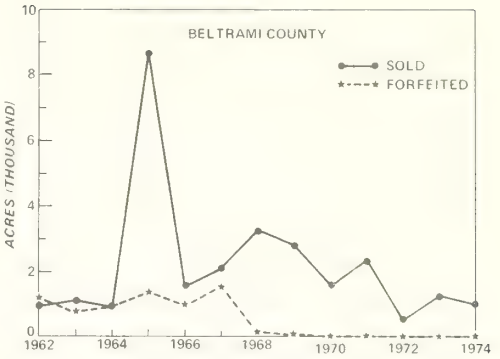
The sales in St. Louis and Mahnomen Counties, the Counties with the most and the least tax-forfeited land increased through the 1960's. Land sales in both Counties decreased in the 1970's.

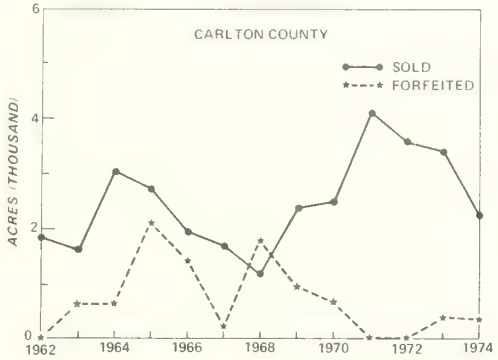
---

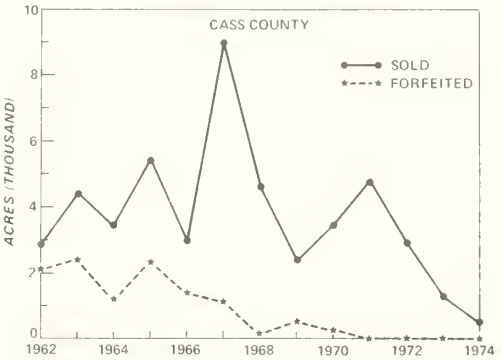
[2]*Lake County held its first land sale auction in more than 10 years in February 1977—approximately 320 acres were sold.*

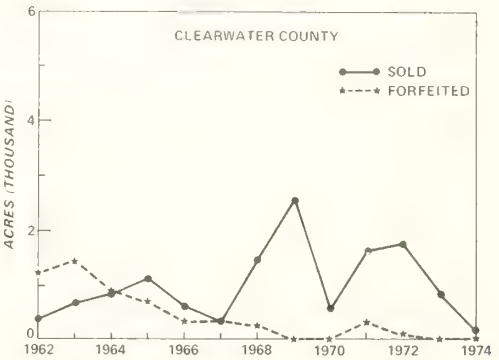

AITKIN COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
5
10
15
20
1962
1964
1966
1968
1970
1972
1974

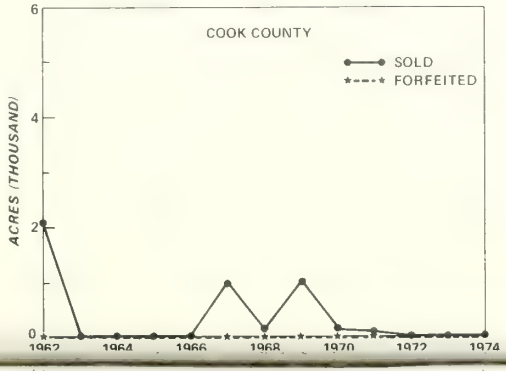

BECKER COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
1
2
3
4
5
1962
1964
1966
1968
1970
1972
1974

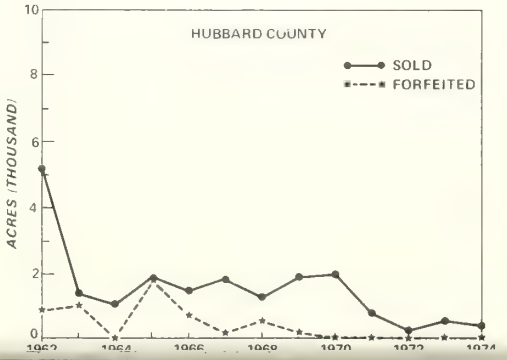

BELTRAMI COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
2
4
6
8
10
1962
1964
1966
1968
1970
1972
1974

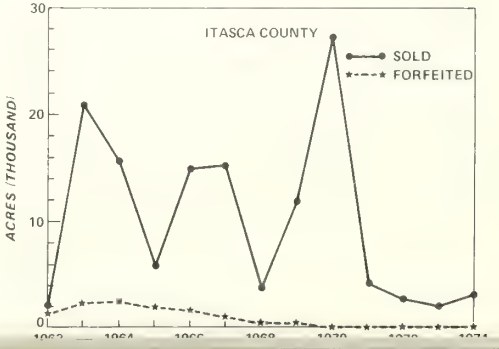

CARLTON COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
2
4
6
1962
1964
1966
1968
1970
1972
1974


CASS COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
2
4
6
8
10
1962
1964
1966
1968
1970
1972
1974


CLEARWATER COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
2
4
6
1962
1964
1966
1968
1970
1972
1974


COOK COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
2
4
6
1962
1964
1966
1968
1970
1972
1974


HUBBARD COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
2
4
6
8
10
1962
1964
1966
1968
1970
1972
1974


ITASCA COUNTY
SOLD
FORFEITED
ACRES (THOUSAND)
0
10
20
30
1962
1964
1966
1968
1970
1972
1974

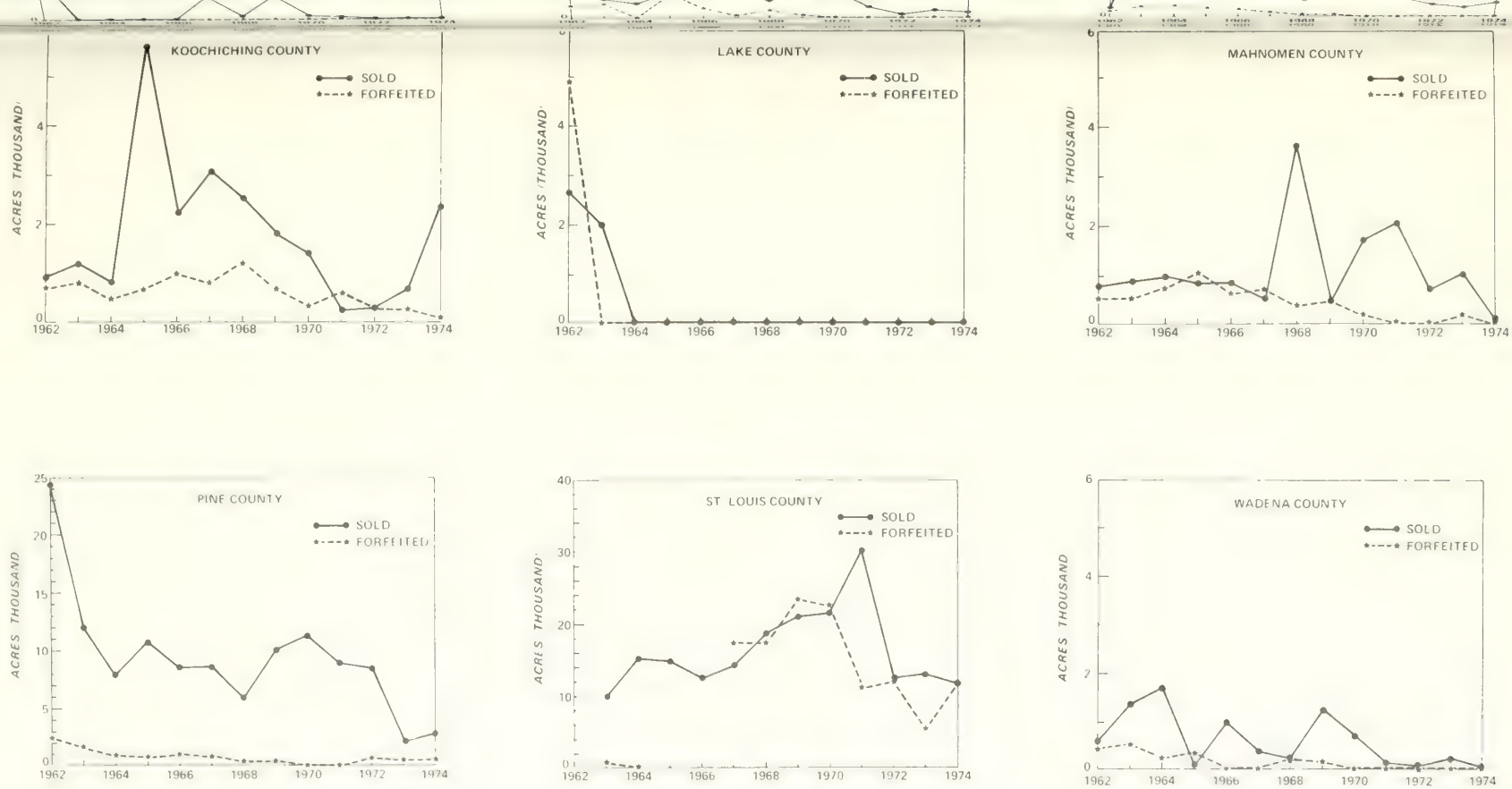


Figure 7.—*Tax-forfeited acres sold and forfeited by county, 1962 to 1974.*

Itasca and Pine Counties have varied greatly from year-to-year in the amount of land sold. Itasca County sold only 2,000 acres one year and then 20,000 acres 2 years later. Sales tapered off substantially in the 1970's. Pine County sold more than 20,000 acres in 1960, then leveled off between 12,000 and 6,000 acres per year throughout the remainder of the 1960's. In 1973 and 1974, sales in Pine County dropped off to between 2,000 and 3,000 acres.

Land forfeitures decreased throughout the period for all counties and they are practically nil at present. The only exception is St. Louis County, where more than 10,000 acres were forfeited in 1974.

The average per acre selling price of tax-forfeited land varied considerably among counties each year (table 1). However, the average selling price per acre in most counties appreciated throughout the period. The exceptions were Wadena and St. Louis Counties. There was no discernable trend in Wadena County but the average selling price per acre, except for one sale in 1972, was significantly lower than that for the other counties. The yearly figures for St. Louis County reflect all types of tax-forfeited land sales and are not limited to regularly scheduled auction sales. The land appreciated from 1963 to 1966, depreciated from 1966 to 1971, and appreciated again from 1972 to the present.

The average annual appreciation rates per acre of tax-forfeited land sold in northern Minnesota, 1960 to 1974, is tabulated below:

	Percent [3]
Cook	*
Lake	*
Wadena	*
Clearwater	9
Becker	10
Itasca	10
Mahnomen	14
Carlton	17
Koochiching	19
Pine	20
St. Louis	20
Aitkin	21
Crow Wing	21
Hubbard	22
Cass	24
Beltrami	27

In summary, the trends presented reveal a significant reduction in county-administered tax-forfeited land during the period. A shift in the supply of this land (number of parcels put up for sale) coupled with a shift in the demand (number of buyers bidding for land) has dramatically increased the average selling price per acre. A closer look at the potential of the remaining tax-forfeited land for supplying timber and other alternative forest based resources along with other nonforest uses, and the planning for the use of this land seems essential at this time.

---

[3] **Signifies either there was little appreciation or there was limited sales so no appreciation rate was calculated.*

Table 1.—*Average selling price of tax-forfeited land by county, 1960 to 1974.*
(In dollars/acre)

County	1960	1962	1964	1966	1968	1970	1971	1972	1973	1974
Aitkin	5.94	6.11	6.38	8.55	13.07	20.64	22.03	34.38	38.32	83.15
Becker	14.49	8.96	11.40	17.93	27.01	14.76	17.00	21.69	30.91	52.67
Beltrami	9.51	9.35	11.88	19.44	41.00	46.80	67.11	71.44	159.86	256.73
Carlton	n.a.[1]	4.18	4.09	3.70	7.11	9.97	12.86	19.18	30.66	37.05
Cass	5.18	5.48	5.24	11.42	14.82	17.79	21.73	32.15	49.20	109.57
Clearwater	6.16	9.98	7.38	15.31	16.17	36.66	19.37	21.99	32.68	12.57
Cook	2.65	6.67	n.s.[2]	n.s.	5.83	n.s.	5.74	n.s.	n.s.	n.s.
Crow Wing	5.70	11.30	6.80	7.64	9.73	27.68	30.85	16.32	64.81	84.82
Hubbard	n.a.	5.53	7.01	10.65	16.70	18.36	24.61	47.17	n.s.	57.80
Itasca	20.38	12.02	25.24	19.22	15.29	20.70	19.18	26.37	60.08	80.95
Koochiching	6.87	9.11	6.97	8.42	10.27	16.91	45.38	43.01	59.96	82.35
Lake	14.49	10.78	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Mahnomen	3.65	3.47	4.16	5.03	6.16	8.11	8.66	15.74	19.70	n.s.
Pine	2.92	3.18	5.93	6.10	7.66	10.88	14.75	18.38	38.84	38.19
St. Louis	n.a.	7.07	12.31	34.07	20.21	14.14	11.99	26.64	33.46	52.25
Wadena	n.s.	3.06	1.43	6.00	1.00	5.14	6.22	182.12	5.47	3.41

[1] Not available.
[2] No sales.

★U. S. GOVERNMENT PRINTING OFFICE: 1978--768440/132 REGION NO. 6

Lothner, David C., Edwin Kallio, and David T. Davis.
1978. Minnesota's tax-forfeited land: some trends in acreages, sales, and prices. U.S. Dep. Agric. Resour. Bull. NC-37, 6 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

The area of tax-forfeited land that is county-administered in Minnesota is currently estimated at almost 2.9 million acres—a decrease of about 17 percent since the mid-1960's. This decrease is the result of a change in land sales, land forfeitures, and other land transfers. Not only have land sales decreased since the early 1960's, but also less land has been forfeited back to the counties. Although the tax-forfeited acreage sold decreased each year, the value of the land sold increased dramatically—from $6.33 per acre in 1960 to nearly $70.00 per acre in 1974.

OXFORD: 922.1:911(776). KEY WORDS: Counties, land use, forest land, forfeitures.

Lothner, David. C., Edwin Kallio, and David T. Davis.
1978. Minnesota's tax-forfeited land: some trends in acreages, sales, and prices. U.S. Dep. Agric. Resour. Bull. NC-37, 6 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

The area of tax-forfeited land that is county-administered in Minnesota is currently estimated at almost 2.9 million acres—a decrease of about 17 percent since the mid-1960's. This decrease is the result of a change in land sales, land forfeitures, and other land transfers. Not only have land sales decreased since the early 1960's, but also less land has been forfeited back to the counties. Although the tax-forfeited acreage sold decreased each year, the value of the land sold increased dramatically—from $6.33 per acre in 1960 to nearly $70.00 per acre in 1974.

OXFORD: 922.1:911(776). KEY WORDS: Counties, land use, forest land, forfeitures.

Shhhh...noise pollutes, too!

USDA FOREST SERVICE
RESOURCE BULLETIN NC-38

Minnesota's Tax-forfeited Land:

UNIVERSITY
NOV 28 19

Some TRENDS in revenues and expenses

David C. Lothner
Edwin Kallio
David T. Davis

rth Central Forest Experiment Station
rest Service, U.S. Department of Agriculture

The authors wish to thank the individual county land commissioners and auditors, Iron Range Resources and Rehabilitation Board, State of Minnesota, and the Minnesota Department of Natural Resources for their cooperation.

North Central Forest Experiment Station
John H. Ohman, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication March 3, 1978
1978

ADMINISTERING MINNESOTA'S TAX-FORFEITED LAND: SOME TRENDS IN REVENUES AND EXPENSES

David C. Lothner, *Economist,*
Edwin Kallio, *Principal Market Analyst,*
and **David T. Davis**, *Supervisory Technician,*
Duluth, Minnesota

SIZE AND BASIC ADMINISTRATION

About 2.9 million acres in 16 northern Minnesota counties is tax-forfeited land—property that has reverted to the State and is administered by local county government because private owners have failed to pay the property tax.

There are two basic ways county land in the 16 northern Minnesota counties are managed: (1) through a land department, and (2) through the county auditor's office.

Twelve of the 16 counties have a land department under the direction of a land commissioner who is appointed by the county board. These counties include: Aitkin, Becker, Beltrami, Carlton, Cass, Clearwater, Crow Wing, Hubbard, Itasca, Koochiching, Lake, and St. Louis. Currently 97.5 percent of tax-forfeited land is managed this way. The land department, depending upon the acreage administered, may include a staff of foresters, timber and land appraisers, and office workers. The basic philosophy of most land departments has been to manage for multiple uses but with heavy emphasis on reforestation and marketing timber products. Recently, recreation, wildlife habitat management, and environmental education have become increasingly more important to some of the counties.

In the remaining four counties—Cook, Mahnomen, Pine, and Wadena—the county auditor's office manages tax-forfeited land. These counties over the past decade or two have either sold the bulk of their land to private owners or transferred the land management duties back to the State under a revenue sharing arrangement. Compared to the former group, these counties have practiced very little forestry. Their primary objective has been to transfer either ownership or management outside county government.

HOW STATE LAW AFFECTS ADMINISTRATION

State law provides that the net revenues, after deducting administrative expenses and any other special funds such as a timber development fund and/or a county park fund, will be apportioned in the following manner: school district, 40 percent; county revenue fund, 40 percent; and organized township or village, 20 percent. For unorganized townships, the 20 percent share generally is apportioned to the county revenue fund. However, in at least one instance, this money is apportioned to the road and bridge fund.

Thus, with this type of law, the counties are in a unique position with respect to other public agencies administering and managing land in Minnesota. They must, for the most part, depend on revenues generated from within their land department activities to cover their costs of

operation, and return the surplus to other county funds. No other public land management agency operating in Minnesota is faced with this type of situation.

How have the county departments fared under this type of financial structure? The purpose of this report is to analyze (1) the trends and sources of revenues generated from the administration of tax-forfeited land and (2) the trends in expenses needed to administer this land.

TRENDS FOR COUNTIES AS A GROUP

Total gross revenues and expenses from administering tax-forfeited land in the 16 northern Minnesota counties changed significantly for the period 1960 through 1974.[1]

Total gross revenues received increased from $1.15 million in 1960 to $3.84 million in 1974 (fig. 1). This is an increase of about 7.8 percent per year. These total figures, however, are heavily weighted by the contribution of St. Louis County because approximately 40 percent of the 16 county tax-forfeited revenue is derived in St. Louis County.[2] Looking at total gross revenues for the other northern Minnesota counties excluding St. Louis County, the increase was from $0.65 million in 1960 to $2.34 million in 1974. The yearly rate of increase, however, remains essentially the same.

Total expenses for administering the tax-forfeited lands in the 16 counties increased from $0.4 million in 1960 to $1.2 million in 1974, a rate of increase of 8.5 percent per year. Again, looking at all counties except St. Louis County, the increase was from $0.24 million in 1960 to $0.82 million in 1974. The rate of increase, excluding the St. Louis County contribution, is slightly higher at about 9.5 percent per year.

Although expenses have increased faster than total gross revenues, revenues have exceeded expenses by a substantial margin throughout the

[1]*The statistics in this bulletin are based on data gathered from three primary sources: Individual county offices, the Iron Range Resources and Rehabilitation Board, and the Minnesota Department of Natural Resources.*

[2]*St. Louis County revenue also includes monies received from mining royalities from county lands. While this money goes directly into the general revenue fund in St. Louis County, it is revenue that is derived from tax-forfeited land.*

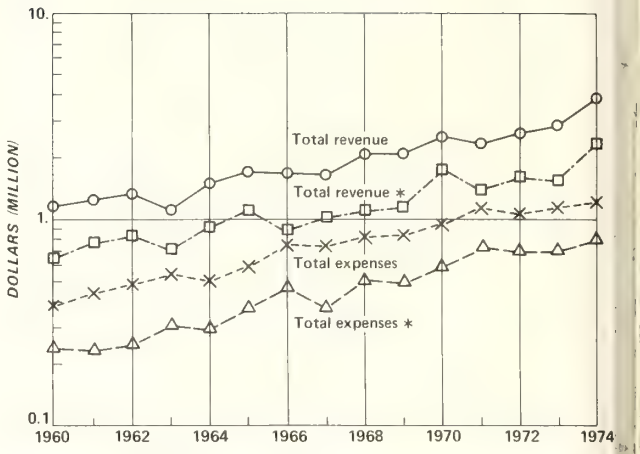


Figure 1.-*Total revenues and expenses from the administration of tax-forfeited land in 16 northern Minnesota counties, 1960 to 1974.* (* *indicates exclusion of St. Louis County.*)

period. In other words, enough revenue has been generated throughout the period to meet current expenses and still apportion monies back to the various county funds prescribed by law. Thus, at first glance, there does not appear to be any financial crisis developing with the counties' capability to generate enough revenue to manage the tax-forfeited lands in the immediate future.

Analyzing Revenue

However, a closer examination of total gross revenues shows there may indeed be some potential problems. Total revenues can be separated into two basic components: (1) revenue from the sale of tax-forfeited land back to private interests and in a few instances to other government agencies; and (2) revenue from the management of this land including the sale of timber stumpage, recreational and hunting leases, easements, hay stumpage, gravel, mining royalties, etc., in addition to federal and state revenue sharing programs. Revenue from the sale of land results in essentially a one-time contribution to the land department or the county tax-forfeited land fund, assuming the land does not go tax delinquent again. This is because land is a capital asset and the sale of this asset represents a depletion of capital to the land department. Revenue from the management and use of the land on the other hand, is a recurring contribution. The same parcel of land can produce annual or other periodic revenue.

An examination of these two basic components reveals that revenue generated from land sale has been a major share of total revenue averaging about 53.5 percent over the 15-year period.[3] The yearly share of land sales ranged from a low of 34 percent to a high of 66 percent. In 10 of the 15 years, land sale revenue was more than 50 percent of the total gross revenue. The average annual increase in land sale revenue was about 10.6 percent.

Therefore, it appears the counties as a group have relied heavily on revenue generated from land sales, and as stated before, have been depleting their capital to help cover administrative costs and provide monies for apportionments to other county funds prescribed by State Law (fig. 2).

Looking at the other side of the coin, recurring revenue from land management activities was not sufficient to cover administrative costs in 10 years of the 15-year period (fig. 3).[4] This was particularly true from 1965 through 1973. Revenue from sources other than land sales was almost constant (no trend) from 1960 through 1969 (fig. 2). Finally in 1970, revenues, primarily from selling timber stumpage, began increasing. In 1974, revenue from timber stumpage and other miscellaneous sources again exceeded administrative costs.

It appears that the counties as a group would have faced rough times in the past if they had relied strictly on revenue from selling timber and other miscellaneous revenue sources to cover their administrative costs and return monies back to the county treasuries for other apportionments. (It can be argued that many of the administrative costs are also associated with appraising land and setting up land sales, and without this program, the administrative costs would have been considerably less. Contrarily, without land sales, many of the administrative efforts could have been channeled into resource management for timber, recreation, wildlife, and minerals that would benefit the public in many other ways.)

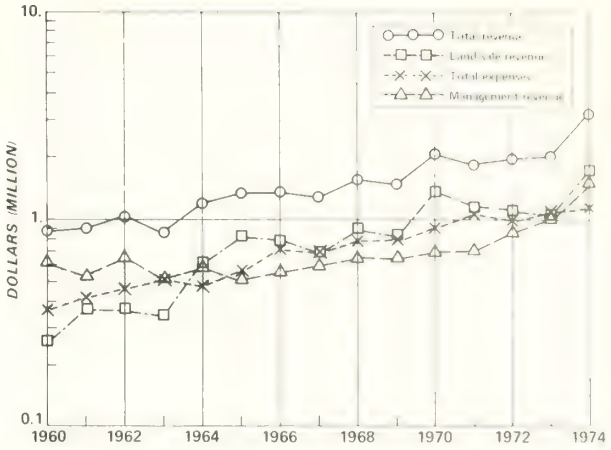


Figure 2.-*Total revenue, revenue components, and total administrative expenses from the administration of tax-forfeited land in 12 northern Minnesota counties, 1960 to 1974.*

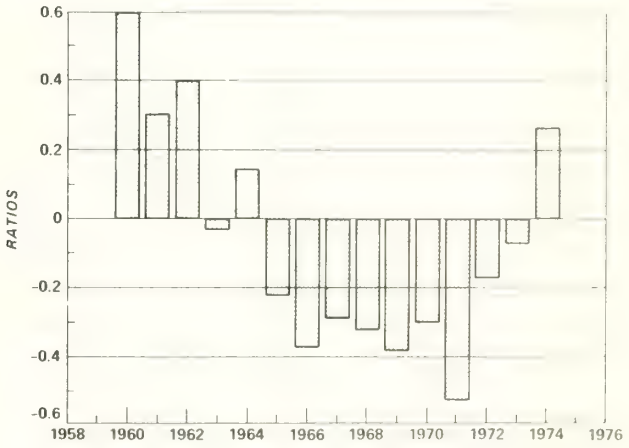


Figure 3.-*Revenues (excluding land sale revenue) and total expense ratios from the administration of tax-forfeited land in 11 northern Minnesota counties, 1960 to 1974.*

INDIVIDUAL COUNTY TRENDS

The acreage that individual counties administer ranges widely from county to county (Lothner *et al.* 1978)[5], as do the revenues and expenses from their administration. Forty percent of the aggregate county total revenue is generated in St. Louis

[3]*Excludes Cook, Crow Wing, Mahnomen, and Pine Counties because of insufficient data for these counties.*

[4]*Benefits still accrued, however, to loggers and others who were dependent on county timber for a livelihood and to the county itself through added employment in timber-based industries.*

[5]*Lothner, David C., Edwin Kallio, and David T. Davis. 1978. Minnesota's tax-forfeited land: some trends in acreages, sales, and prices. U.S. Dep. Agric. For. Serv. Resour. Bull. NC-37, 6 p. North Cent. For. Exp.Stn., St. Paul, Minnesota.*

County. St. Louis along with Itasca and Koochiching account for 67 percent of the total revenue generated from tax-forfeited lands. Timber production is a major management objective. Koochiching and Itasca Counties ranked one and two among the 16 counties in timber sale revenue for the 1972-1974 period, averaging $201 thousand and $109 thousand, respectively. Revenues and expenses by county are given in figure 4.

Growth in total revenue over the 1960 to 1974 period was the fastest in Becker and Carlton Counties (fig. 4). They had an average rate of growth of 12.5 percent and 11 percent per year, respectively. In Becker County, the growth was largely due to increases in revenue from land sales. In Carlton County, on the other hand, total revenue growth was largely due to the 23 percent annual average increase in timber stumpage and other miscellaneous revenue.

In contrast, Lake and Hubbard Counties had the slowest rate of growth in total revenue (fig. 4). Lake County total revenue was highly variable in the early 1960's before leveling off in the late 1960's, and little trend can be seen. The major reason for the slow growth rate in Lake County total revenue resulted from no land sales after 1963. Hubbard County, likewise, shows very little trend. However, Hubbard's land sale revenue increased from 30 percent of total revenue to approximately 50 percent over the period.

HOW COUNTIES COVER ADMINISTRATIVE EXPENSES

Earlier we looked at how counties as a group covered expenses from timber sales and other land management revenues. There is sufficient detail to look at 11 counties individually (fig. 4).

We have categorized the counties into four separate groups. It should be emphasized that in looking at the county's capability of covering administrative expenses, we make no judgments on management efficiency. The counties differ in their management philosophy and they vary in their emphasis on nonrevenue generating programs, which often provide intangible benefits but also cost dollars.

Two counties where revenues exceeded expenses throughout the period. Both Beltrami and Koochiching Counties fall into this group (fig. 4). Beltrami County, however, has experienced a 21 percent per year increase in expenses, whereas, revenue from land management sources remained almost constant until 1969 before accelerating to about a 16 percent per year increase in the 1970's. Koochiching County, on the other hand, had an even rate of growth for total revenues, land management revenue, and expenses throughout the period. The sharp increase in land sale revenue in 1974 was primarily due to county land sold for inclusion in the Voyageurs National Park.

Two counties where an early surplus of revenue became a deficit. Both Aitkin and Hubbard Counties started out the period with surplus revenue (fig. 4). Aitkin County lost its surplus in 1965 and remained in a deficit position through the end of the period. Expenses increased at a 12 percent annual rate while there was little change in land management revenue throughout the period until a dramatic increase in 1973 and 1974. Hubbard County started out the period with a large surplus which diminished over the period. Beginning in 1972, expenses exceeded land management revenue and increased at a 10 percent annual rate, while land management revenue showed little change throughout the period.

Four counties having alternating periods of a surplus and deficit. Cass, Clearwater, Itasca, and Lake Counties all fall into this group (fig. 4). Cass County had a surplus for 13 of the 15 years. Land management revenue remained quite stable through 1969 before accelerating at a 22 percent annual rate after 1969. Expenses, meanwhile, increased at a 15-percent-per-year rate over the period.

In Clearwater County, land management revenue and expenses increased at a fairly similar rate over the period. Revenues, however, exceeded expenses in 11 of the 15 years.

Lake County witnessed extreme variations in land management revenue and expenses. Revenues again, however, exceeded in 11 of the 15 years.

Itasca County had land management revenues exceeding expenses in 9 of the 15 years.

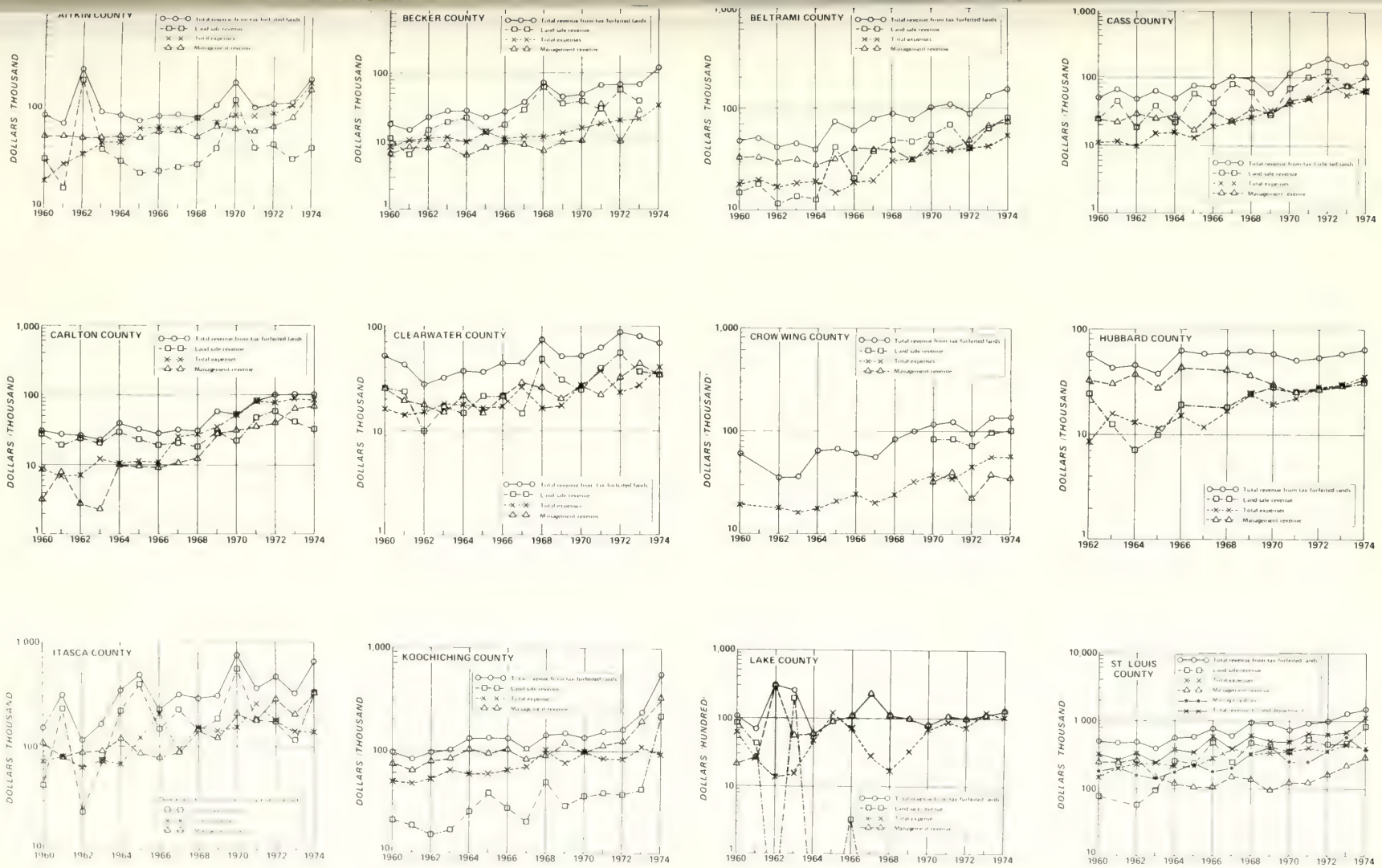


Figure 4.-*Total land sale, and management revenues, and total expenses by individual county, 1960 to 1974. A surplus of land management revenue over total administrative expenses is shaded.*

Three counties with a deficit over almost the entire period. Becker, Carlton, and St. Louis Counties (fig. 4) had very few years in a land management revenue surplus position. Two counties relied quite heavily on land sale revenue. St. Louis County, on the average during 1972 to 1974 period, depended upon land sale revenue for over 70 percent of the total revenue to the land department, while the land sale share for Becker was 65 percent. The land sale share for Carlton County for the same period was 45 percent.

Thus, throughout the 1960 to 1974 period, only 2 of 11 counties—Beltrami and Koochiching—consistently administered their tax-forfeited land without depending upon revenue from land sales.

A further review of the information in figure 4 will permit the reader to make additional observations about the individual counties.

☆U. S. GOVERNMENT PRINTING OFFICE: 1978—768-820/56

Lothner, David C., Edwin Kallio, and David T. Davis.
1978. Administering Minnesota's tax-forfeited land: some trends in revenues and expenses. U.S. Dep. Agric. For. Serv. Resour. Bull. NC-38, 6 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Revenues received from managing Minnesota county land increased at a slower rate than the expenses incurred in their management over the 1960-1974 period. However, due to a substantial land sale program, the revenues received exceeded the expenses incurred throughout the period.

OXFORD: 922.2:911(776). KEY WORDS: Counties, management costs, management revenues, land sales, forest administration.

Lothner, David C., Edwin Kallio, and David T. Davis.
1978. Administering Minnesota's tax-forfeited land: some trends in revenues and expenses. U.S. Dep. Agric. For. Serv. Resour. Bull. NC-38, 6 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Revenues received from managing Minnesota county land increased at a slower rate than the expenses incurred in their management over the 1960-1974 period. However, due to a substantial land sale program, the revenues received exceeded the expenses incurred throughout the period.

OXFORD: 922.2:911(776). KEY WORDS: Counties, management costs, management revenues, land sales, forest administration.

More bicycles and shoe leather...less smog.

)A FOREST SERVICE
SOURCE BULLETIN **NC-39**

CLEMSON UNIVERSITY LIBRARY
JUL 17 1979
SCI., TECH. & AGR. DIV.
GOVT. DOCUMENTS
DEPOSITORY ITEM
JUL 18 1979
CLEMSON
LIBRARY

PRIMARY FOREST PRODUCTS INDUSTRY & TIMBER USE MINNESOTA

1973

James E. Blyth
Steven Wilhelm
Jerold T. Hahn

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication January 3, 1979
1979

FOREWORD

This publication contains the results of the first detailed study of forest industry and industrial roundwood production in Minnesota since 1960. Such detailed information is necessary for intelligent planning and decisionmaking in wood procurement, forest resource management, and forest industry development. Also, researchers need current forest industry and industrial roundwood information for planning projects.

Many of the comparisons in this report are for 1960 and 1973, although these years may not be typical of Minnesota timber products output and use. Available production and receipt data for specific products in intervening or previous years are included for comparative purposes.

Special thanks are given to the primary wood-using firms that supplied information for this study. Their cooperation is greatly appreciated.

Quantities shown may vary slightly from one table to another because of rounding differences but these differences are insignificant.

HIGHLIGHTS

- Active primary wood-using mills declined from 1,861 in 1953 to 1,345 in 1960 to 253 in 1973, but the average volume of logs and bolts processed per mill increased several fold.
- Industrial roundwood production rose 21 percent from 1960 to 1973.
- Ninety-four percent of the 141.2 million cubic feet of industrial roundwood cut in 1973 was pulpwood (71 percent) and saw logs (23 percent).
- Estimated timber removals (from growing stock on commercial forest land) for industrial roundwood in 1973 were 136.1 million cubic feet compared to 107.3 million cubic feet in 1960.
- Forty-seven percent of timber removals was aspen.
- Pulpwood production was 1.38 million cords in 1973 compared to 1.05 million cords in 1960.
- Saw log production was 178 million board feet, 6 percent higher than in 1960. Two thirds was hardwood, half of which was aspen.
- Average lumber production per sawmill was 750,000 board feet.
- Sawmills in Itasca, St. Louis, and Clearwater Counties cut 44 percent of Minnesota's lumber.
- Veneer log production in 1973 was half the average annual production between 1954 and 1963.
- Seventy-one percent of coarse residue generated by primary mills was used.
- Additional markets are needed for fine residue and bark. Seventy-five percent of the fine residue and 79 percent of the bark generated by primary mills was not used.

PRIMARY FOREST PRODUCTS INDUSTRY AND TIMBER USE, MINNESOTA, 1973

James E. Blyth, *Principal Market Analyst,*
North Central Forest Experiment Station,
St. Paul, Minnesota,

Steven Wilhelm, *formerly Staff Forester,*
Marketing & Utilization,
Minnesota Department of Natural Resources,
St. Paul, Minnesota,

and **Jerold T. Hahn,** *Principal Mensurationist,*
North Central Forest Experiment Station,
St. Paul, Minnesota

PRIMARY FOREST INDUSTRY — INDUSTRIAL ROUNDWOOD

Minnesota's primary[1] forest industry dropped to 253 active mills in 1973 from 1,345 in 1960 and 1,861 in 1953. Many small mills closed due to competition from larger, more efficient, and better-financed mills. Major mills are concentrated in the eastern half of Minnesota and particularly in the Northern Pine and Northern Aspen-Birch Units (fig. 1).

Industrial roundwood receipts in 1973 at all mills (except treating plants) were 121.3 million cubic feet, one-third higher than in 1960. More than half (53 percent) was aspen and about one-third (32 percent) was softwoods. Hardwood receipts in 1973 were more than 50 percent greater than in 1960, but softwood receipts fell about 5 percent. Minnesota mills (excluding treating plants) imported only 1 percent of their roundwood requirements in 1973.

Industrial roundwood production in 1973 was 141.2 million cubic feet, up from 116.9 million cubic feet in 1960. From 1960 to 1973 softwood production declined an average 1.7 percent annually while hardwood production rose an average 4.3 percent annually. Pulpwood and saw logs comprised 94 percent of the industrial roundwood produced in 1973.

Large quantities of the roundwood required by industry in 1973 was harvested from public land — 70 percent of the softwood volume and 47 percent of the hardwood. Production by owner class was:

Owner class	Softwood	Hardwood
	(In million cubic feet)	
Federal:		
National Forest	11.1	9.2
Other	4.3	2.9
State	15.4	11.9
County	6.6	17.0
Private:		
Forest industry	7.7	9.7
Other	8.0	37.4
All owners	53.1	88.1

The Northern Aspen-Birch and Northern Pine Units furnished all but 1 percent of the industrial roundwood harvested from public land in 1973.

TIMBER REMOVALS FOR INDUSTRIAL ROUNDWOOD

Estimated timber removals (from growing stock on commercial forest land) for industrial

[1] *Mills receiving roundwood or chips from roundwood are primary mills.*

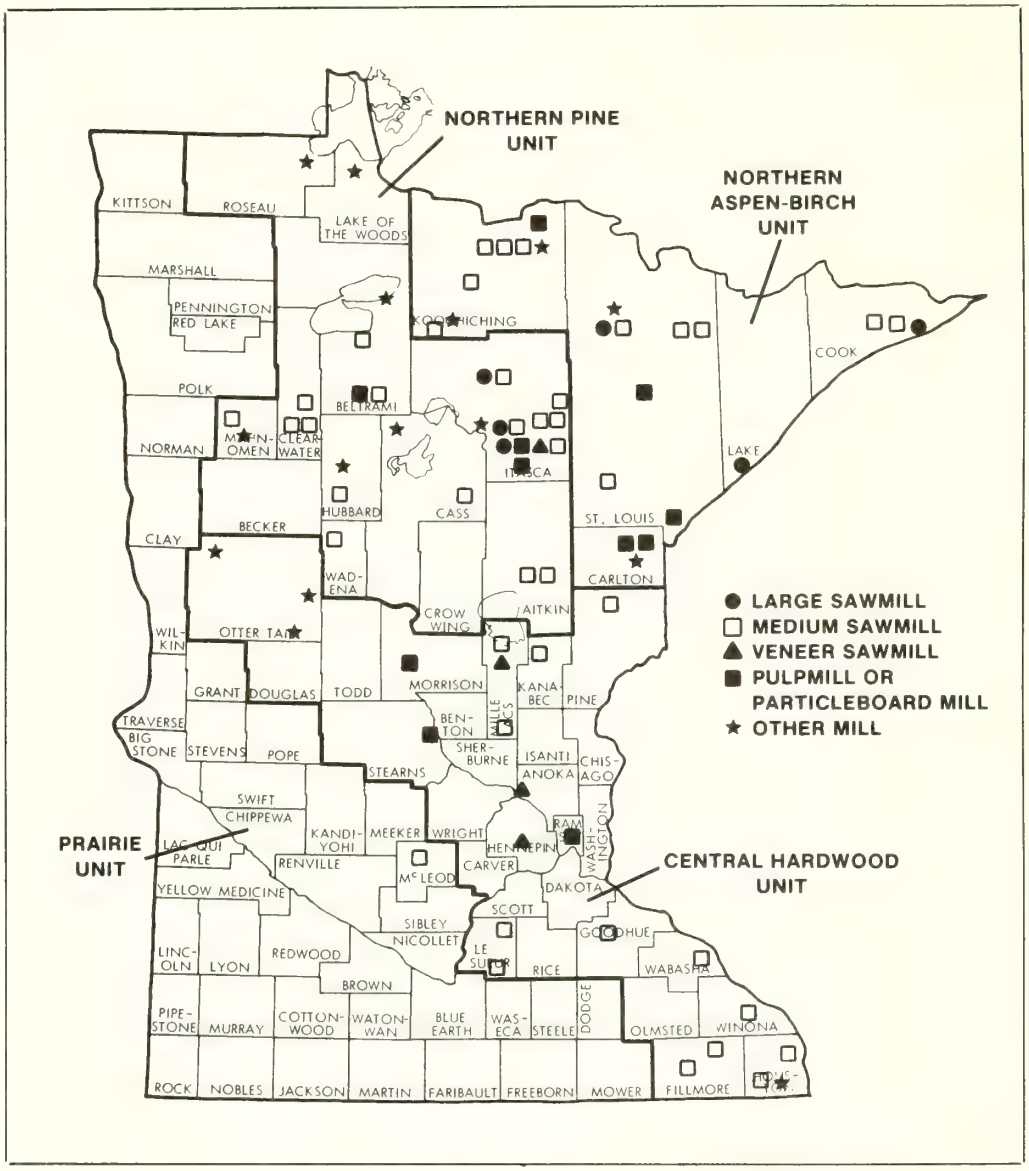


Figure 1.— *Primary wood-using plants and Forest Survey Units in Minnesota, 1973. Sawmills are classed by volume of lumber produced in 1973: large = 5 million board feet or more; medium = 1 to 4.999 million board feet (smaller sawmills not shown). The Forest Survey Units are the geographic areas used by the Resources Evaluation Project to report periodic inventories and use of the Nation's forest resources.*

roundwood in 1973 were 136.1 million cubic feet, 27 percent more than in 1960. Softwood and hardwood removals in 1960 and 1973 were:

	Removals		Percent change
	1960	1973	
	(in million cubic feet)		
Softwood	60.2	51.5	−14
Hardwood	47.1	84.6	+80

Before using these data, the relation between industrial roundwood production and timber removals should be reviewed (table 1). Eight percent of the industrial roundwood came from nongrowing stock and was not part of the timber removals. Also, timber removals for fuelwood and noncommercial posts or other removals are not included (see footnote 3, table 1). However, logging residue from growing stock generated during production of industrial roundwood is added to industrial roundwood harvested from growing stock to determine timber removals for industrial roundwood.

In 1973, removals in principal species[2] were:

Species	Removals
	(Million cubic feet)
Jack pine	17.7
Spruce	17.4
Balsam fir	6.2
Red pine	3.7
White pine	3.1
Aspen	64.5
Paper birch	4.9
Red oak	3.3

Aspen clearly dominated 1973 timber removals; it comprised nearly half (47 percent) of all timber removals and three-fourths of hardwood removals.

Five counties each had more than 8 million cubic feet of removals — St. Louis, Koochiching, Itasca, Beltrami, and Lake. Together they accounted for 65 percent of timber removals for industrial roundwood in 1973.

[2] *Common and scientific names of all species mentioned in this report are listed in the Appendix.*

Table 1.—*Industrial roundwood production, timber removals, and their relation, Minnesota, 1973*
(In million cubic feet)

Item	From growing stock on commercial forest land	From nongrowing stock[1]	Total
Industrial roundwood:			
Pulpwood	90.8	9.4	100.2
Saw logs	31.1	0.8	31.9
Other[2]	8.4	0.7	9.1
Subtotal	130.3	10.9	141.2
Logging residue	5.8	(4)	(4)
Timber removals[3]	136.1		

[1] Includes cull trees, dead trees, saplings, and trees on nonforest land.
[2] Includes veneer logs, poles, commercial posts, piling, particleboard, bolts, shaving bolts, lath bolts, charcoal bolts, and chips from roundwood.
[3] For industrial roundwood only. Does not include timber removals for fuelwood and noncommercial posts or other removals. Other removals are growing stock trees removed but not used for products or trees left standing but "removed" from the commercial forest land classification by land use change.
[4] Not available.

PULPWOOD

Pulpwood production was 1.4 million cords in 1973, higher than in any previous year. Ninety-two out of 100 cords were roundwood; the remainder was wood residue (used at pulpmills) from sawmills, veneer mills, and other mills. Until 1966, the residue component of annual production never exceeded 1 percent (fig. 2).

During the last quarter century, hardwood roundwood has become a more important component of pulpwood output. Aspen has always been the dominant hardwood cut for pulp; nine-tenths was aspen in 1973. Since 1968, however, the increase in the average annual rate of production from other hardwoods has been greater than for aspen (fig. 3).

From 1964 to 1973, an average of 213,000 cords of pine were cut per year, and pine was the major softwood pulping species. Spruce was close behind with an average of 195,000 cords per year. Pine pulpwood cut in 1973 consisted of jack pine (90 percent), red pine (6 percent), and white pine (4 percent). No noticeable harvesting trend for pine

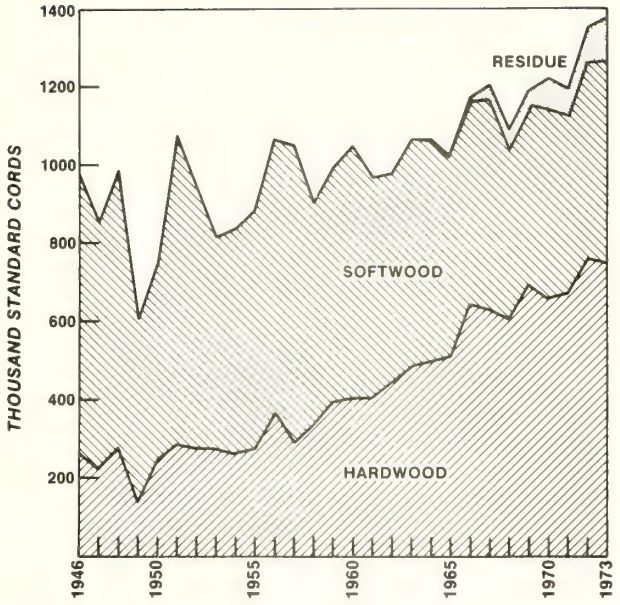


Figure 2.— *Minnesota pulpwood production trends, 1946-1973.*

and spruce has been evident in recent years. Some mills are highly dependent on these species for manufacturing paper products. Generally, pulpwood harvesting from other softwoods has been declining since 1957.

Most (84 percent in 1973) Minnesota pulpwood is used in the State. Wisconsin is the major out-of-State consumer. Pine, spruce, and aspen are the principal export species.

Nine Minnesota mills received 1.2 million cords of pulpwood in 1973, near the record high set in 1972 (fig. 4). All but 13 percent was roundwood and only 6 percent was imported (primarily as residue chips) from other States and Canada.

Pulpwood receipts rose an average 2.7 percent yearly since 1946. Several sharp gains and losses during this period resulted from mills adjusting their wood inventories and meeting changing demands for their products. Demand for aspen has been strong in recent years; demand for softwoods has been stable. Birch consumption since 1970 has equalled consumption of all other hardwoods except aspen. Use of residue for pulpwood has grown rapidly since 1965.

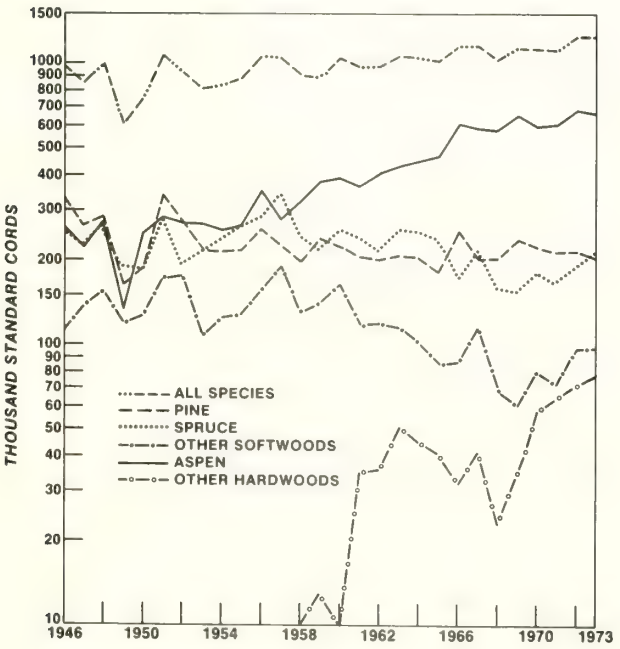


Figure 3.— *Minnesota round pulpwood production by species groups, 1946-1973.*

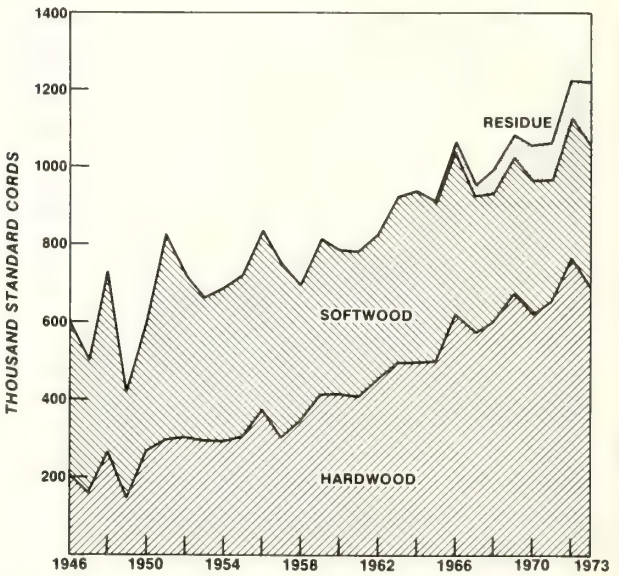


Figure 4.— *Pulpwood receipts in Minnesota, 1946-1973.*

SAW LOGS

Minnesota loggers harvested 178 million board feet of saw logs in 1973, a 6 percent rise from 168 million board feet cut in 1960. Saw log demand was heavy for railroad ties, pallets, furniture, crating, and construction.

Sixty-nine percent of the output was hardwoods; half of the hardwood was aspen. Other important species cut were red oak, white pine, jack pine, red pine, and elm.

Minnesota mills sawed all but 7 million board feet of these logs. Wisconsin mills procured 96 percent of the export logs; principal species purchased were red oak, balsam fir, and basswood.

Aspen output climbed 23 million board feet from 1960 as it found widespread acceptance for furniture parts and pallets and greater acceptance in construction. Overall, hardwood saw log production rose 30 million board feet. In contrast, softwood saw log output fell 21 million board feet compared to 1960; major losses were in white pine (11 million board feet) and jack pine (10 million board feet). Meanwhile, demand for cedar, an underutilized species, more than doubled.

Northern Pine Unit forests furnished half (51 percent) of the saw logs including 72 percent of the aspen, 80 percent of the jack pine, and 54 percent of the red pine.

Loggers in the Northern Aspen-Birch Unit cut one-fourth of the saw log volume including a majority of the white pine, balsam fir, spruce, and cedar. Four southeastern counties, where railroad tie markets are strong, supplied 59 percent of the red oak volume.

Top-producing counties were Itasca, St. Louis, Clearwater, and Koochiching. Half (48 percent) of the aspen saw log output came from Itasca County. White and red pine demand was strong in St. Louis County.

More than 200 Minnesota sawmills procured 172 million board feet of logs in 1973. Imports, totaling less than 2 million board feet, came from Iowa and Wisconsin; red oak was the chief import.

Sawmills in three counties (Itasca, St. Louis, and Clearwater) cut 44 percent of Minnesota's lumber (fig. 5). These counties contain four of the six large sawmills (each sawing 5 million board feet or more of lumber annually). Average lumber production per sawmill was 750,000 board feet, six times the average in 1960. The rapid rise in output per mill is due to many small mills closing, larger capacity mills being built, and some mills expanding their production.

OTHER PRODUCTS

Other industrial roundwood products (6 percent of all industrial roundwood) cut in Minnesota in 1973 were veneer logs, particleboard bolts, poles, commercial posts, piling, lath bolts, charcoal wood, cooperage bolts, shaving bolts, match bolts, and specialty bolts for dowels and nursery flats. Most of these products are cut in the Northern Aspen-Birch and Northern Pine Units.

Since 1970 Minnesota loggers produced annually about half the veneer log volume that was cut each year between 1954 and 1963. Four Minnesota veneer mills closed since 1960. Of the 5.1 million board feet of veneer logs harvested in 1973, red oak and cottonwood were primary components.

Particleboard bolts and shaving bolts used for poultry litter and livestock bedding are new roundwood products since 1960. These products together with larger commercial post production led to a 42 percent rise in output in 1973 (compared to 1960) in the "other product" category.

PRIMARY PLANT RESIDUE

During 1973, Minnesota primary wood-using plants (except pulpmills) generated 232,000 green tons of coarse residue, 136,000 green tons of fine residue, and 109,000 green tons of bark. The percent of each residue class not utilized (piled, land fill, burned as waste, etc.) was:

Class of residue	Softwood	Hardwood
	(Percent)	
coarse	31	28
fine	81	73
bark	82	78

Markets for coarse residue were fair but 22,000 green tons of softwood and 45,000 green tons of hardwood were not used. Markets were poor for fine residue and bark. The Northern Aspen-Birch

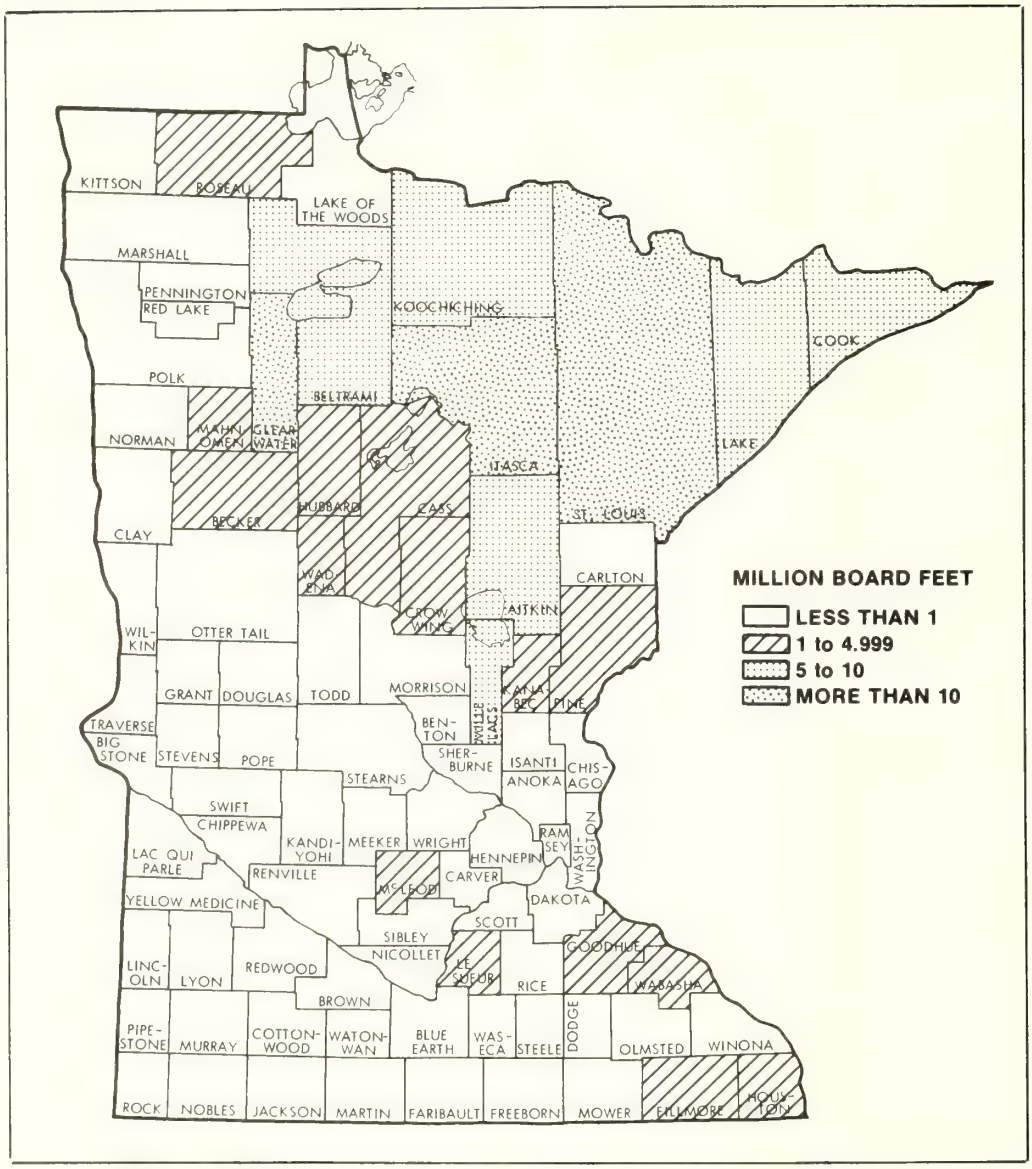


Figure 5.—*Lumber production in Minnesota counties, 1973.*

Unit had the largest volume of unused residue in each class. St. Louis, Clearwater, and Itasca Counties each had more than 10,000 green tons of unmarketable coarse and fine residue.

Primary markets for residue were as follows: pulpwood — coarse residue; domestic fuelwood — bark; and mulch, bedding, litter, etc. — fine residue. A large quantity of bark and sawdust was not used, but it may become an important supplemental fuel for companies with inadequate supplies of other fuel.

Estimates of residue in 1973 by type of disposal for each county are found in the Appendix. Individuals or firms desiring wood or bark residue can select procurement areas where high concentrations of residue are available.

APPENDIX

STUDY METHODS

Data for this publication came from a complete canvass of primary wood-using firms that process Minnesota logs and bolts and all public agencies that administer Minnesota forest land. The study was a cooperative effort between the North Central Forest Experiment Station (NCFES) and the Minnesota Department of Natural Resources (DNR). Special thanks are given to the NCFES field crews of the Resources Evaluation Project and the Regional Utilization and Marketing Specialists of the DNR for contacting the nonrespondents to a mailed questionnaire. DNR foresters provided estimates for a few Minnesota mills which did not furnish data. The DNR canvassed public agencies (other than Federal, which was done by the NCFES) to determine the 1973 timber products harvest on land they administer.

The NCFES canvassed out-of-State mills that use Minnesota roundwood and followed-up on nonrespondents. The Station edited and compiled the data.

The authors gratefully acknowledge the fine cooperation of the primary wood-using firms that made this study possible.

Logging utilization factors developed from a logging study by the Station in 1975-1976 were used to estimate timber and sawtimber removals for industrial roundwood in 1973.

DEFINITION OF TERMS

Timber removals for industrial roundwood — The volume of sound bole wood (between a 1-foot stump and a minimum top diameter of 4.0 inches outside bark or to a point where the central stem breaks into limbs) in poletimber and sawtimber growing-stock trees on commercial forest land removed annually for industrial roundwood products (including logging residues).

Sawtimber removals for industrial roundwood — The volume of sound bole wood (between a 1-foot stump and the point on the bole above which a saw log cannot be produced) in sawtimber growing-stock trees on commercial forest land removed annually for industrial roundwood products (including logging residues). The minimum saw log top is 7.0 inches diameter outside bark for softwoods and 9.0 inches diameter outside bark for hardwoods.

Commercial forest land — Forest land that is producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Generally, this includes areas suitable for growing crops of industrial wood in excess of 20 cubic feet per acre annually.

Industrial roundwood products — Saw logs, pulpwood, veneer logs, poles, commercial posts, piling, particleboard bolts, shaving bolts, lath bolts, charcoal bolts, and chips from roundwood.

Industrial roundwood production — The quantity of industrial roundwood harvested in a geographic area.

Industrial roundwood receipts — The quantity of industrial roundwood received in a geographic area regardless of the geographic source.

Consumption — The quantity of a commodity, such as pulpwood, utilized.

Growing-stock trees — All live poletimber and sawtimber trees of commercial species except rough and rotten trees. Poletimber trees are 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches d.b.h. for hardwoods. Softwood sawtimber trees are 9.0 inches d.b.h. or larger; hardwood sawtimber trees are 11.0 inches d.b.h. or larger.

Primary wood-using plant residue — Wood materials (coarse and fine) and bark not utilized for principal products at manufacturing plants using roundwood. These residues include wood products (byproducts) obtained incidental to production of principal products and wood materials not utilized for some product.

Coarse plant residue — Wood residue suitable for chipping such as slabs, edging, and veneer cores.

Fine plant residue — Wood residue not suitable for chipping such as sawdust and veneer clippings.

COMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

SOFTWOOD SPECIES

Pine:	
Eastern white pine	*Pinus strobus*
Red pine	*Pinus resinosa*
Jack pine	*Pinus banksiana*
Spruce:	
White spruce	*Picea glauca*
Black spruce	*Picea mariana*
Balsam fir	*Abies balsamea*
Tamarack	*Larix laricina*
Northern white-cedar	*Thuja occidentalis*

HARDWOOD SPECIES

White oak:	
White oak	*Quercus alba*
Bur oak	*Quercus macrocarpa*
Swamp white oak	*Quercus bicolor*
Red oak:	
Northern red oak	*Quercus rubra*
Black oak	*Quercus velutina*
Northern pin oak	*Quercus ellipsoidalis*
Hickory:	
Bitternut hickory	*Carya cordiformis*
Shagbark hickory	*Carya ovata*
Birch:	
Yellow birch	*Betula alleghaniensis*
Paper birch	*Betula papyrifera*
Hard maple:	
Black maple	*Acer nigrum*
Sugar maple	*Acer saccharum*
Soft maple:	
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Ash:	
Black ash	*Fraxinus nigra*
White ash	*Fraxinus americana*
Green ash	*Fraxinus pennsylvanica*
Balsam poplar	*Populus balsamifera*
Aspen:	
Bigtooth aspen	*Populus grandidentata*
Quaking aspen	*Populus tremuloides*
Eastern cottonwood	*Populus deltoides*
American basswood	*Tilia americana*
Black walnut	*Juglans nigra*
Elm:	
American elm	*Ulmus americana*
Rock elm	*Ulmus thomasii*
Slippery elm	*Ulmus rubra*

Table 2. *Industrial roundwood production in Minnesota, 1953, 1960, and 1973*
(In million cubic feet)

	All species			Softwoods			Hardwoods		
Product	**1953**	**1960**	**1973**	**1953**	**1960**	**1973**	**1953**	**1960**	**1973**
Pulpwood	72.5	83.2	100.2	51.7	51.5	40.9	20.8	31.7	59.3
Saw logs	31.2	27.3	31.9	16.4	12.3	10.1	14.8	15.0	21.8
Veneer logs	1.1	1.4	0.8	(1)	—	—	1.1	1.4	0.8
Poles and piling	1.3	1.4	1.0	1.3	1.4	1.0	—	—	—
Mine timbers	1.9	0.6	—	1.7	0.5	—	0.2	0.1	—
Posts[2]	—	0.4	1.0	—	0.4	1.0	—	—	—
Miscellaneous[3]	2.6	2.6	6.3	0.4	0.2	0.2	2.2	2.4	6.1
Total	110.6	116.9	141.2	71.5	66.3	53.2	39.1	50.6	88.0

[1] Less than 50,000 cubic feet.
[2] Includes only posts processed at fence and treating plants.
[3] Includes match and clothespin stock, particleboard bolts, hewn ties, shaving bolts, cabin logs, cooperage bolts, etc.

Table 3.—*Volume of industrial roundwood production by type of product in Minnesota, 1973*

Product	Standard units	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
		Thousand standard units			Thousand cubic feet		
Pulpwood	Standard cords	1,269	518	751	100,201	40,901	59,300
Saw logs	Board feet[1]	177,521	55,233	122,288	31,905	10,075	21,830
Veneer logs	Board feet[1]	5,076	—	2,076	814	—	814
Piling	Linear feet	239	239	—	155	155	—
Poles	Pieces	143	143	—	856	856	—
Posts[2]	Pieces	1,227	1,227	—	980	980	—
Miscellaneous[3]	Cubic feet	6,309	196	6,113	6,309	196	6,113
Total	Cubic feet	141,220	53,163	88,057	141,220	53,163	88,057

[1] International 1/4-inch rule.
[2] Includes only posts processed at fence and treating plants.
[3] Includes match stock, particleboard bolts, lath bolts, shaving bolts, and cooperage bolts.

Table 4.—*Industrial roundwood products output by landowner class and unit, Minnesota, 1973*
(In thousand cubic feet)

Owner class	Northern Aspen-Birch		Northern Pine		Central Hardwood		Prairie		All Units	
	Soft-woods	Hard-woods	Soft-woods	Hard-woods	Soft-woods	Hard-woods	Soft-woods	Hard-woods	Soft-woods	Hard-woods
Federal:[1]										
National Forest	8,690	4,347	2,392	4,831	—	—	—	—	11,082	9,178
Other	1,286	537	2,923	2,209	81	176	—	—	4,290	2,922
State	8,299	6,095	6,974	5,238	146	535	6	20	15,425	11,888
County	2,296	7,554	4,334	9,395	—	—	—	—	6,630	16,949
Private:										
Forest industry[2]	5,945	8,031	1,800	1,648	—	4	—	—	7,745	9,683
Other	5,591	14,870	2,004	11,022	136	10,451	260	1,094	7,991	37,437
All owners	32,107	41,434	20,427	34,343	363	11,166	266	1,114	53,163	88,057

[1] Does not include commercial posts.
[2] Primary wood-using firms owning forest land, except sawmills cutting less than 100,000 board feet annually.

Table 5.—*Number of active primary wood-using mills in Minnesota, 1953, 1960 and 1973*

Kind of mill	All units			Northern Aspen-Birch	Northern Pine	Central Hard-wood	Prairie
	1953	1960	1973	1973	1973	1973	1973
Pulpmills	9	9	9	4	2	3	—
Sawmills							
Large[1]	3	1	6	3	3	—	—
Medium[2]	93	26	42	11	17	13	1
Small[3]	1,719	1,255	175	39	99	28	9
Veneer mills	9	7	3	—	—	2	1
Misc. plants[4]	28	47	18	5	8	5	—
Total	1,861	1,345	253	62	129	51	11

[1] Annual lumber production of 5 million board feet or more.

[2] Annual lumber production of from 1 million to 4.999 million board feet or more in 1960 and 1973; annual production of 0.500 million to 4.999 million board feet in 1953.

[3] Annual lumber production less than 1 million board feet in 1960 and 1973; annual production less than 0.500 million board feet in 1953.

[4] Includes particleboard plants, cooperage mills, lath mills, shaving mills, a match plant, and a charcoal plant.

Table 6.—*Major industrial roundwood receipts by type of mill in Minnesota, 1960 and 1973*
(In million cubic feet)

Type of mill	All species		Softwoods		Aspen		Other hardwoods	
	1960	1973	1960	1973	1960	1973	1960	1973
Pulpmills	61.9	83.8	29.1	28.8	31.9	48.8	0.9	6.2
Sawmills	26.4	30.9	11.5	9.7	5.5	11.2	9.4	10.0
Other mills[1]	2.7	6.6	0.1	0.3	1.5	4.7	1.1	1.6
Total	91.0	121.3	40.7	38.8	38.9	64.7	11.4	17.8

[1] Does not include treating plants.

Table 7.—*Timber removals for industrial roundwood by species, unit, and county in Minnesota, 1973*
(In million cubic feet)

UNIT AND COUNTY	BALSAM FIR	CEDAR	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASS-WOOD	PAPER BIRCH	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARD-WOODS	ALL SPECIES
NORTHERN ASPEN-BIRCH																							
CARLTON	37	0	154	12	4	44	2	41	2808	0	17	371	0	0	20	0	4	2	37	1	0	0	3554
COOK	92	29	336	11	549	1766	0	0	405	0	114	135	0	0	0	0	0	0	0	0	0	0	3437
KOOCHICH.	1980	650	746	113	239	5957	792	129	10366	1276	13	184	0	0	178	0	0	18	0	0	0	0	22641
LAKE	348	0	2097	304	400	1727	2	11	2258	0	0	434	10	0	0	0	0	0	0	0	0	0	4091
ST.LOUIS	1105	52	5815	1157	903	3339	302	1	17367	1106	5	782	0	0	0	0	0	1	0	0	0	0	31875
UNIT TOTAL	3562	731	9148	1597	2095	12833	1098	182	33144	2382	149	2406	10	0	198	0	4	21	37	1	0	0	69598
NORTHERN PINE																							
AITKIN	51	0	85	52	47	121	243	330	2360	0	203	255	0	0	219	5	45	55	179	41	0	0	4291
BECKER	116	0	193	115	17	9	18	24	174	2	57	33	0	0	75	0	9	0	77	40	0	0	959
BELTRAMI	718	86	1377	330	184	961	119	13	3993	1	102	586	0	0	73	0	13	7	29	3	0	0	8595
CASS	87	3	1566	600	254	103	124	2	2523	0	39	348	0	0	8	0	0	0	29	1	0	0	5687
CLEARWATER	31	0	681	192	23	228	158	277	2431	35	0	261	0	0	453	0	0	0	70	47	0	0	4887
CROW WING	2	0	699	156	90	0	2	8	563	0	62	45	0	0	44	0	19	24	157	32	0	0	1903
HUBBARD	22	0	933	104	36	16	72	0	2060	0	0	15	0	0	0	0	0	0	0	0	0	0	3258
ITASCA	1577	74	1005	347	292	1427	497	49	11495	53	239	733	0	0	26	0	0	0	7	0	0	60	17881
LAKE-WOODS	16	60	399	27	24	1238	26	5	581	57	0	11	0	0	7	0	0	2	0	0	0	0	2453
MAHNOMEN	0	0	4	8	1	0	26	59	283	6	28	11	0	0	74	0	0	0	56	157	0	0	713
ROSEAU	12	0	940	8	0	206	21	2	160	0	0	0	0	0	0	0	0	0	0	0	0	0	1349
WALENA	0	0	476	97	10	0	0	4	322	63	12	1	0	0	18	0	1	0	13	9	0	0	1026
UNIT TOTAL	2432	223	8358	2036	978	4309	1306	773	26945	217	742	2299	0	0	997	5	87	88	617	330	0	60	53002
CENTRAL HARDWOODS																							
ANOKA	0	1	0	4	4	5	0	25	418	106	4	5	0	2	104	0	0	0	11	2	0	0	691
BENTON	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	2	2	2	1	0	0	10
CARVER	0	0	0	0	0	0	0	1	0	0	18	0	0	1	18	0	8	7	11	8	0	0	72
CHISAGO	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	6	1	0	0	11
DAKOTA	0	0	0	0	0	0	0	0	0	0	1	0	0	2	5	0	2	4	10	0	0	0	24
DOUGLAS	0	0	0	0	0	0	0	3	7	0	6	0	0	2	6	0	0	0	4	2	0	0	30
FILLMORE	0	0	0	0	0	0	0	1	1	0	88	12	0	4	177	9	34	0	597	169	21	1	1116
GOODHUE	0	0	0	0	0	11	0	24	26	0	36	7	0	51	71	8	63	46	40	15	15	17	430
HENNEPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	36
HOUSTON	0	0	0	0	0	0	0	1	9	0	73	1	0	36	45	0	23	1	440	68	43	14	754
ISANTI	0	0	0	0	7	0	0	17	4	0	1	0	0	5	11	0	2	4	9	3	0	0	63
KANABEC	0	0	0	0	0	0	0	0	265	0	14	0	0	20	11	0	3	6	57	5	0	0	381
LE SUEUR	0	0	0	0	0	0	0	20	0	0	54	0	0	26	56	0	23	12	38	16	2	2	249
MILLE LACS	0	0	0	0	2	3	64	47	1492	0	83	59	0	38	114	0	3	12	188	63	0	2	2170
MORRISON	0	0	76	22	5	0	0	5	424	0	24	20	0	2	59	0	0	6	42	56	0	0	743
OLMSTEAD	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	1	2	26	7	10	0	50
OTTER TAIL	0	0	0	1	8	0	0	45	398	63	239	19	0	1	96	0	11	0	102	42	0	0	1029
PINE	3	0	98	8	0	0	0	36	1003	0	34	35	0	0	43	0	3	5	13	6	0	0	1287
RICE	0	0	0	1	0	0	0	7	0	0	21	0	0	15	25	0	14	3	23	15	6	4	136
SCOTT	0	0	6	0	0	0	0	4	0	0	24	0	0	2	25	0	10	8	18	10	0	1	102
SHERBURNE	0	0	0	0	0	0	0	12	0	0	1	0	0	1	5	0	0	6	29	0	0	0	54
STEARNS	0	0	0	0	0	0	0	10	9	0	41	1	0	7	83	0	2	0	16	9	0	0	178
TODD	0	0	22	1	0	0	0	8	336	84	24	4	0	2	57	0	6	8	31	17	0	0	600
WABASHA	0	0	0	0	1	0	0	5	10	0	48	2	0	108	75	0	7	32	488	50	7	34	867
WINONA	0	0	0	0	0	0	0	11	1	0	73	10	0	110	92	0	17	6	443	62	7	50	882
WRIGHT	0	0	0	0	0	0	0	1	1	0	1	0	0	2	4	0	8	0	0	0	0	0	17
UNIT TOTAL	3	1	196	37	27	19	68	283	4406	253	912	175	0	440	1324	17	244	170	2644	627	111	125	11902
PRAIRIE																							
BLUE EARTH	0	0	0	0	0	0	0	1	0	0	0	0	0	11	4	0	0	0	0	0	4	0	20
BROWN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
CHIPPEWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	22
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	28
FARIBAULT	0	0	0	0	0	0	0	0	0	0	0	0	0	83	0	0	0	0	0	0	0	0	83
KANDIYOHI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLEOD	0	0	0	0	0	0	0	17	1	0	24	0	0	185	133	0	0	19	8	9	0	0	396
MARSHALL	0	0	0	0	0	29	0	0	0	0	0	7	0	0	0	0	0	0	0	3	0	0	39
MEEKER	0	0	0	0	0	0	0	17	1	0	13	0	0	87	68	0	0	12	9	11	0	0	218
NICOLLET	0	0	0	0	0	0	0	8	0	0	25	0	0	7	26	0	9	5	17	8	2	0	107
NORMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	37	0	0	0	0	0	0	0	0	37
PENNINGTON	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	4
POLK	0	0	5	2	0	172	50	18	0	0	22	0	0	100	49	0	0	0	0	5	0	0	423
REDWOOD	0	0	0	0	0	0	0	1	0	0	0	0	0	14	3	0	0	1	0	0	0	0	19
RENVILLE	0	0	0	0	0	0	0	1	0	0	0	0	0	13	3	0	0	1	0	0	0	0	18
SIBLEY	0	0	0	0	0	0	0	1	0	0	7	0	0	20	8	0	2	1	2	0	0	0	41
STEELE	0	0	0	0	0	0	0	1	0	0	2	0	0	1	4	0	6	0	3	1	0	0	18
STEVENS	0	0	0	0	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	0	4
SWIFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	22
WASECA	0	0	0	0	0	0	0	2	0	0	7	0	0	2	7	0	2	2	5	2	0	0	29
UNIT TOTAL	0	0	5	2	0	201	50	68	2	0	101	7	0	590	350	0	19	42	44	42	6	0	1529
STATE TOTAL	6197	955	17707	3672	3100	17362	2522	1306	64497	2852	1904	4887	10	1030	2769	22	354	321	3342	1000	117	185	136111

Table 8.—*Sawtimber removals for industrial roundwood by species, unit, and county in Minnesota, 1973*
(In thousand board feet, International ¼-inch rule)

UNIT AND COUNTY	BALSAM FIR	CEDAR	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD	PAPER BIRCH	YELLOW BIRCH	COTTONWOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARDWOODS	ALL SPECIES
NORTHERN ASPEN-BIRCH																							
CARLTON	90	0	307	35	13	98	4	157	6535	0	82	309	0	0	98	0	18	16	70	5	0	0	7837
COOK	365	139	707	22	2978	4516	0	0	1366	0	68	640	2	0	0	0	0	0	0	0	0	0	10743
KOOCHICH.	4709	2945	1483	458	601	13417	1744	645	24346	1161	65	546	0	0	482	0	0	90	0	0	0	0	53092
LAKE	1428	0	4693	1188	2057	4296	5	51	5896	0	0	4173	59	0	0	0	0	0	0	0	0	0	24046
ST.LOUIS	3136	241	12440	5168	4542	7695	664	3	42596	1622	28	1120	0	0	0	0	0	9	2	0	0	0	79266
UNIT TOTAL	9828	3325	19630	6871	10191	30022	2417	856	80739	2783	243	6828	61	0	580	0	18	115	72	5	0	0	174984
NORTHERN PINE																							
AITKIN	117	0	242	274	260	271	532	1638	6561	0	1013	496	0	0	1786	24	232	275	920	214	0	0	14155
BECKER	523	0	717	639	90	27	89	124	668	10	289	163	0	0	376	0	48	0	400	208	0	0	4371
BELTRAMI	1623	376	2847	1253	908	2175	243	57	9515	8	509	442	0	0	741	0	8	7	142	18	0	0	20472
CASS	342	9	3748	2354	1322	225	273	10	6195	0	194	344	0	0	42	0	0	2	149	5	0	0	15114
CLEARWATER	119	0	2793	830	109	502	351	1378	6875	171	0	1040	0	0	2355	0	0	0	362	242	0	0	17027
CROW WING	3	0	1569	740	455	0	9	44	1596	0	313	89	0	0	221	0	99	121	813	167	0	0	6239
HUBBARD	50	0	2058	329	150	36	161	0	4688	0	0	9	0	0	0	0	0	0	0	0	0	0	7481
ITASCA	4295	294	2545	1737	1525	3424	1095	242	36709	58	1188	1100	0	0	135	0	0	2	36	1	0	301	54687
LAKE-WOODS	40	133	1359	97	109	2760	66	25	2001	34	0	56	0	0	40	0	0	10	0	0	0	0	6730
MAHNOMEN	0	0	23	50	5	0	69	291	1073	30	201	51	0	0	171	0	0	0	347	809	0	0	3320
ROSEAU	40	0	3341	15	0	492	48	11	395	0	0	0	0	0	0	0	0	0	0	0	0	0	4342
WALENA	0	0	1167	494	30	0	0	16	1576	357	55	5	0	0	88	0	8	0	70	45	0	0	3911
UNIT TOTAL	7452	812	22409	8812	4963	9912	2936	3836	77852	668	3762	3795	0	0	4955	24	395	417	3239	1709	0	301	157849
CENTRAL HARDWOODS																							
ANOKA	0	5	0	23	23	28	0	125	1664	526	17	24	0	15	518	0	0	0	58	13	0	0	3039
BENTON	0	0	0	0	0	0	0	1	1	0	9	0	0	0	15	0	13	10	11	7	0	0	67
CARVER	0	0	0	0	0	0	0	9	0	0	92	0	0	7	91	0	43	35	57	41	0	3	378
CHISAGO	0	0	0	1	0	0	0	3	9	0	0	2	0	0	15	0	2	0	28	5	0	0	65
DAKOTA	0	0	0	0	0	0	0	1	0	0	4	0	0	10	26	0	13	21	51	2	0	0	128
DOUGLAS	0	0	0	0	0	0	0	17	32	0	31	2	0	10	33	0	3	0	25	11	1	0	165
FILLMORE	0	0	0	0	0	0	0	8	4	0	473	56	0	36	881	49	178	0	3102	846	107	8	5788
GOODHUE	0	0	0	0	0	55	0	120	104	0	178	40	0	276	764	39	350	233	209	79	77	80	2204
HENNEPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	21
HOUSTON	0	0	0	0	0	0	0	6	33	0	360	5	0	192	227	0	118	5	2328	381	220	80	3955
ISANTI	0	0	0	1	41	0	0	82	18	0	8	0	0	24	51	0	13	19	49	20	0	0	326
KANABEC	0	0	0	0	0	0	0	3	797	0	77	2	0	100	48	0	18	30	294	26	0	0	1395
LE SUEUR	0	0	0	0	0	0	0	104	0	0	269	0	0	142	282	0	116	67	200	83	13	11	1287
MILLE LACS	0	0	0	0	10	6	143	169	3805	0	353	49	0	193	564	0	17	61	765	327	0	11	6473
MORRISON	0	0	150	113	22	0	0	26	1140	0	133	37	0	10	392	0	1	29	222	288	1	0	2464
OLMSTEAD	0	0	0	0	1	0	0	2	1	0	9	1	1	7	14	0	5	10	139	33	50	0	273
OTTER TAIL	0	0	1	3	47	0	18	232	2177	357	1299	99	0	5	681	0	58	0	538	221	0	0	5536
PINE	7	0	195	17	2	1	0	177	2337	0	167	51	0	0	213	0	17	24	63	29	0	0	3300
RICE	0	0	0	5	0	0	0	37	0	0	107	0	0	76	127	0	84	21	119	76	28	20	700
SCOTT	0	0	0	0	0	0	0	20	0	0	121	0	0	14	126	0	56	45	93	55	0	6	536
SHERBURNE	0	0	0	0	0	0	0	55	0	0	6	0	0	0	24	0	2	33	147	3	0	0	276
STEARNS	0	0	0	0	0	0	0	47	33	0	203	6	0	35	415	0	11	2	82	50	1	0	885
TODD	0	0	45	3	1	0	0	46	1874	472	121	22	0	10	288	0	31	43	162	86	0	0	3204
WABASHA	0	0	0	0	4	0	0	24	39	0	234	12	2	430	749	2	34	158	2518	259	37	29	4031
WINONA	0	0	0	0	2	0	0	52	6	0	363	47	1	356	251	0	89	33	2287	344	36	30	3847
WRIGHT	0	0	0	0	0	0	0	4	3	0	6	0	0	12	17	0	52	0	2	3	0	0	99
UNIT TOTAL	7	5	391	166	153	90	161	1370	14077	1355	4640	455	4	1966	5833	90	1324	879	13549	3328	571	278	50492
PRAIRIE																							
BLUE EARTH	0	0	0	0	0	0	0	8	0	0	0	0	0	51	16	0	0	0	0	0	21	0	96
BROWN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6	0	0	0	0	6
CHIPPEWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	0	0	0	0	0	0	0	111
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	138	0	0	0	0	0	0	0	0	138
FARIBAULT	0	0	0	0	0	0	0	0	0	0	0	0	0	413	0	0	0	0	0	0	0	0	413
KANDIYOHI	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
MCLEOD	0	0	0	0	0	0	0	84	6	0	117	0	0	920	661	0	4	95	45	49	0	0	1981
MARSHALL	0	0	0	0	0	138	0	0	0	0	0	39	0	0	0	0	0	0	0	17	0	0	194
MEEKER	0	0	0	0	0	0	0	84	6	0	61	0	0	433	338	0	0	57	46	58	0	0	1083
NICOLLET	0	0	0	0	0	0	0	45	0	0	125	0	0	35	133	0	50	26	87	40	9	2	552
NORMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	143	0	0	0	0	0	0	0	0	183
PENNINGTON	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	19	0	0	23
POLK	0	0	11	4	0	380	113	88	0	0	107	0	0	500	238	0	0	0	0	21	0	0	1462
REDWOOD	0	0	0	0	0	0	0	5	0	0	2	0	0	73	17	0	0	5	0	1	0	0	103
RENVILLE	0	0	0	0	0	0	0	5	0	0	1	0	0	69	17	0	0	5	0	1	0	0	98
SIBLEY	0	0	0	0	0	0	0	4	0	0	39	0	0	116	47	0	11	8	15	1	0	0	241
STEELE	0	0	0	0	0	0	0	5	0	0	15	0	0	4	17	0	30	3	16	6	2	0	98
STEVENS	0	0	0	0	0	0	0	5	0	0	0	0	0	10	5	0	0	0	0	0	0	0	20
SWIFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	0	0	0	0	0	0	0	111
WASECA	0	0	0	0	0	0	0	12	0	0	35	0	0	14	35	0	15	14	24	11	3	0	163
UNIT TOTAL	0	0	11	4	0	518	113	345	12	0	506	39	0	2961	1746	0	110	219	233	224	35	2	7078
STATE TOTAL	16487	4142	42441	15853	15307	40542	5627	6407	172680	4806	9151	11117	65	4927	13314	114	1847	1630	17093	5266	606	581	390403

Table 9.— *Minnesota pulpwood production by species group, 1946-1973*
(In thousand standard cords, rough wood basis)

Year	Roundwood							Residue		Total
	Pine	Spruce	Balsam fir	Tamarack	Aspen	Birch	Other hardwoods	Softwood	Hardwood	
1946	333	258	93	19	265	1	(1)	—	8	977
1947	266	225	119	18	221	(1)	—	—	3	852
1948	286	269	150	5	276	2	(1)	—	—	988
1949	163	190	117	3	133	(1)	—	—	—	606
1950	187	185	126	1	248	(1)	1	—	—	748
1951	340	280	153	18	283	1	2	—	—	1,077
1952	194	293	163	13	270	2	2	—	—	937
1953	218	215	101	6	268	1	4	—	—	813
1954	214	237	118	7	254	1	6	—	—	837
1955	218	265	120	8	266	4	5	—	—	886
1956	259	287	140	14	353	5	9	—	—	1,067
1957	223	345	173	18	277	7	6	—	—	1,049
1958	198	241	116	14	324	2	8	—	—	903
1959	239	220	130	11	381	1	12	—	—	994
1960	225	256	145	19	392	1	10	—	—	1,048
1961	206	240	111	8	368	1	34	—	—	968
1962	201	217	110	9	406	2	34	—	—	979
1963	208	255	102	13	433	(1)	51	—	1	1,063
1964	204	256	90	12	451	(1)	45	(1)	5	1,063
1965	181	237	74	12	468	(1)	41	1	4	1,018
1966	256	172	80	7	612	1	31	2	13	1,174
1967	202	218	76	40	591	3	39	7	29	1,205
1968	203	157	43	26	583	1	22	16	36	1,087
1969	237	154	40	21	660	3	32	5	40	1,192
1970	221	181	45	36	600	31	27	17	66	1,224
1971	214	168	40	32	607	34	31	22	48	1,196
1972	216	192	66	31	689	42	30	25	63	1,354
1973	205	215	66	32	673	42	36	26	82	1,377

[1] Less than 500 cords.

Table 10.—*Pulpwood receipts in Minnesota by species group, 1946-1973*
(In thousand standard cords, roundwood basis)

Year	Roundwood							Residue		Total
	Pine	Spruce	Balsam fir	Tamarack	Aspen	Birch	Other hardwoods	Softwood	Hardwood	
1946	175	141	62	6	207	—	—	—	8	599
1947	160	122	48	6	158	—	—	—	3	497
1948	187	195	77	3	264	—	(1)	—	—	726
1949	111	114	48	1	144	—	—	—	—	418
1950	177	108	41	1	267	—	1	—	—	595
1951	241	202	74	9	296	—	1	—	—	823
1952	154	191	62	9	302	(1)	2	—	—	720
1953	165	153	42	6	292	(1)	4	—	—	662
1954	163	171	52	6	289	(1)	6	—	—	687
1955	177	176	58	7	298	2	5	—	—	723
1956	204	176	69	9	365	3	9	—	—	835
1957	156	210	74	10	292	5	6	—	—	753
1958	161	133	55	3	338	2	7	—	—	699
1959	195	128	69	3	405	1	12	—	—	813
1960	164	116	85	3	408	1	10	—	—	787
1961	187	120	67	—	375	1	34	—	—	784
1962	189	111	75	—	418	1	34	—	—	828
1963	190	157	77	—	446	(1)	50	—	1	921
1964	213	153	68	—	455	—	43	—	6	938
1965	205	138	60	(1)	462	(1)	39	—	8	912
1966	207	155	60	(1)	588	1	31	—	21	1,063
1967	179	115	49	2	551	1	25	5	31	958
1968	206	92	33	(1)	576	(1)	27	13	46	993
1969	231	84	33	(1)	633	3	40	7	51	1,082
1970	188	111	42	—	557	31	33	22	74	1,058
1971	154	116	40	(1)	585	34	38	32	64	1,063
1972	166	128	65	4	686	41	36	23	75	1,224
1973	156	142	60	7	618	41	38	51	110	1,223

[1] Less than 500 cords

Table 11.— *Minnesota pulpwood production by species group and destination, 1973*
(In thousand standard cords, rough wood basis)

Species group	Destination of wood				
	Minnesota	Wisconsin	Michigan	Other States and Canada	Total
ROUNDWOOD[1]:					
Pine	154	49	—	2	205
Spruce	142	57	—	16	215
Balsam fir	61	5	—	(2)	66
Tamarack	6	26	—	—	32
Aspen	609	56	(2)	8	673
Birch	41	(2)	(2)	1	42
Other hardwoods	34	(2)	(2)	2	36
Total	1,047	193	(2)	29	1,269
RESIDUE:					
Softwoods	24	1	—	1	26
Hardwoods	82	—	—	—	82
ALL MATERIAL	1,153	194	(2)	30	1,377

[1] Includes chips from roundwood.
[2] Less than 500 cords.

Table 12.— *Pulpwood receipts in Minnesota by species group and area of origin, 1973*
(In thousand standard cords, rough wood basis)

Species group	Area of origin				
	Minnesota	Wisconsin	Other states	Canada	Total
ROUNDWOOD[1]:					
Pine	155	—	—	1	156
Spruce	141	—	—	1	142
Balsam fir	60	—	—	—	60
Tamarack	7	—	—	—	7
Aspen	609	—	—	9	618
Birch	41	—	—	—	41
Other hardwoods	34	—	—	4	38
Total	1,047	—	—	15	1,062
RESIDUE:					
Softwoods	23	—	26	2	51
Hardwoods	82	15	3	10	110
ALL MATERIAL	1,152	15	29	27	1,223

[1] Includes chips from roundwood.

Table 13.—*Pulpwood production from roundwood by unit, county, and species group, Minnesota, 1973*
(In standard cords, rough wood basis)

NORTHERN ASPEN-BIRCH UNIT

County	Balsam fir	Jack pine	Red pine	White pine	Spruce	Tamarack	soft-woods	Ash	Aspen	Balsam poplar	American Basswood	Paper birch	Eastern Cottonwood	Elm	Hard maple	Soft maple	Red oak	Other species	Hardwoods	All species
Carlton	450	2,070	102	45	557	24	3,268	122	37,920	—	—	4,710	—	9	15	—	357	—	43,133	46,401
Cook	891	4,325	148	314	19,987	—	25,665	—	2,000	—	1,529	—	—	—	—	—	—	—	3,529	29,194
Koochiching	24,144	9,957	616	2,747	76,321	10,354	124,139	—	136,217	15,794	—	1,188	—	—	—	—	—	—	153,199	277,338
Lake	372	25,360	1,667	696	20,133	27	48,255	—	26,185	—	—	2,722	—	—	—	—	—	—	28,957	77,212
St. Louis	11,305	71,685	3,902	1,842	41,926	3,946	134,606	16	204,676	11,811	—	8,712	—	—	—	6	—	—	225,221	359,827
Unit total	37,162	113,397	6,435	5,644	158,944	14,351	335,933	138	406,998	27,605	1,529	17,382	—	9	15	6	357	—	454,039	789,972
NORTHERN PINE UNIT																				
Aitkin	638	790	70	—	1,557	3,160	6,215	—	21,682	—	—	2,376	—	—	—	—	—	—	24,058	30,273
Becker	204	1,009	32	21	83	—	1,349	—	193	—	—	—	—	—	—	—	—	—	193	1,542
Beltrami	9,153	11,020	1,020	311	12,156	1,354	35,014	9	51,363	—	—	7,531	—	68	175	100	30	—	59,276	94,290
Cass	869	12,189	1,682	353	1,336	1,621	18,050	—	29,482	—	—	4,239	—	—	—	—	—	—	33,721	51,771
Clearwater	142	1,960	706	73	2,966	2,076	7,923	—	22,511	—	—	792	—	—	—	—	—	—	23,303	31,226
Crow Wing	20	8,354	427	165	—	—	8,966	—	5,147	—	—	418	—	—	—	—	—	—	5,565	14,531
Hubbard	276	9,279	608	191	212	933	11,499	—	28,277	—	—	198	—	—	—	—	—	—	28,475	39,974
Itasca	16,683	10,802	557	393	17,240	6,499	52,174	—	61,178	627	—	7,920	—	—	—	—	—	—	69,725	121,899
Lake of the Woods	176	2,835	216	79	15,961	281	19,548	—	5,160	761	—	—	—	—	—	—	—	—	5,921	25,469
Mahnomen	—	—	—	—	—	284	284	—	438	—	—	—	—	—	—	—	—	—	438	722
Roseau	107	5,711	100	—	2,519	194	8,631	—	1,901	—	—	—	—	—	—	—	—	—	1,901	10,532
Wadena	—	5,344	201	108	—	—	5,653	—	799	—	—	—	—	—	—	—	—	—	799	6,452
Unit total	28,268	69,293	5,619	1,694	54,030	16,402	175,306	9	228,131	1,388	—	23,474	—	68	175	100	30	—	253,375	428,681
CENTRAL HARDWOOD UNIT																				
Hennepin	—	—	—	—	—	—	—	—	—	—	—	—	—	478	—	—	—	—	478	478
Kanabec	—	—	—	—	—	—	—	—	2,065	—	—	—	—	—	—	—	—	—	2,065	2,065
Mille Lacs	—	—	—	—	38	849	887	199	17,311	—	199	736	—	—	—	—	596	—	19,041	19,928
Morrison	—	1,009	32	21	—	—	1,062	—	4,361	—	—	198	—	—	—	—	—	—	4,559	5,621
Pine	20	1,317	99	1	5	—	1,442	—	13,481	—	—	396	—	—	—	—	—	—	13,877	15,319
Todd	—	301	14	—	—	—	315	—	—	—	—	—	—	—	—	—	—	—	—	315
Wabasha	—	—	—	—	—	—	—	—	--	—	—	—	412	412	—	—	—	424	1,248	1,248
Winona	—	—	—	—	—	—	—	—	—	—	—	—	642	642	—	—	—	660	1,944	1,944
Unit total	20	2,627	145	22	43	849	3,706	199	37,218	—	199	1,330	1,054	1,532	—	—	596	1,084	43,212	46,918
PRAIRIE UNIT																				
Polk	—	75	30	1	2,258	669	3,033	—	—	—	—	—	—	—	—	—	—	—	—	3,033
Unit total	—	75	30	1	2,258	669	3,033	—	—	—	—	—	—	—	—	—	—	—	—	3,033
State total	65,450	185,392	12,229	7,361	215,275	32,271	517,978	346	672,347	28,993	1,728	42,186	1,054	1,609	190	106	983	1,084	750,626	1,268,604

Table 14.—*Saw log production in Minnesota by species, 1960 and 1973*
(In thousand board feet, International 1/4-inch rule)

Species	1960	1973	Change
Softwoods:			
Balsam fir	4,170	5,638	1,468
Cedar	2,050	4,428	2,378
Jack pine	23,468	13,294	−10,174
Red pine	16,090	12,500	−3,590
White pine	25,678	14,489	−11,189
Spruce	3,383	4,686	1,303
Tamarack	1,287	198	−1,089
All swds.	76,126	55,233	−20,893
Hardwoods:			
Ash	4,223	6,272	2,049
Aspen	37,587	60,704	23,117
Balsam poplar	621	2,333	1,712
Basswood	9,165	7,299	−1,866
Paper birch	3,722	3,893	171
Yellow birch	874	49	−825
Cottonwood	4,993	3,850	−1,143
Elm	8,876	12,817	3,941
Hard maple	585	1,431	846
Soft maple	1,582	1,485	−97
Red oak	15,033	15,783	750
White oak	4,147	5,226	1,079
Walnut	234	574	340
Other hwds.	342	572	230
All hwds.	91,984	122,288	30,304
All species	168,110	177,521	9,411

Table 15.—*Saw log production by unit, species, and State of destination, Minnesota, 1973*

(In thousand board feet, International ¼-inch rule)

ALL UNITS

SPECIES	MINNESOTA	WISCONSIN	MISSOURI	IOWA	OTHER STATES	TOTAL
SOFTWOODS:						
BALSAM FIR	4198	1440	0	0	0	5638
CEDAR	4428	0	0	0	0	4428
JACK PINE	12964	330	0	0	0	13294
RED PINE	12255	245	0	0	0	12500
WHITE PINE	14204	285	0	0	0	14489
SPRUCE	4686	0	0	0	0	4686
TAMARACK	198	0	0	0	0	198
TOTAL SWDS	52933	2300	0	0	0	55233
HARDWOODS:						
ASH	6262	10	0	0	0	6272
ASPEN	60483	221	0	0	0	60704
BALSAM POP	2333	0	0	0	0	2333
BASSWOOD	6724	575	0	0	0	7299
PAP. BIRCH	3886	7	0	0	0	3893
YEL. BIRCH	49	0	0	0	0	49
COTTONWOOD	3679	126	0	45	0	3850
ELM	12690	102	0	25	0	12817
HICKORY	117	1	0	0	0	118
HARD MAPLE	1421	10	0	0	0	1431
SOFT MAPLE	1385	100	0	0	0	1485
RED OAK	12565	3200	0	18	0	15783
WHITE OAK	4964	260	0	2	0	5226
WALNUT	317	63	194	0	0	574
OTHER SPP.	444	10	0	0	0	454
TOTAL HWDS	117319	4685	194	90	0	122288
ALL SPECIES	170252	6985	194	90	0	177521

NORTHERN ASPEN-BIRCH UNIT

SPECIES	MINNESOTA	WISCONSIN	MISSOURI	IOWA	OTHER STATES	TOTAL
SOFTWOODS:						
BALSAM FIR	1838	1440	0	0	0	3278
CEDAR	3574	0	0	0	0	3574
JACK PINE	2309	330	0	0	0	2639
RED PINE	5365	245	0	0	0	5610
WHITE PINE	9250	285	0	0	0	9535
SPRUCE	3558	0	0	0	0	3558
TAMARACK	2	0	0	0	0	2
TOTAL SWDS	25896	2300	0	0	0	28196
HARDWOODS:						
ASH	846	0	0	0	0	846
ASPEN	11462	180	0	0	0	11642
BALSAM POP	1560	0	0	0	0	1560
BASSWOOD	147	0	0	0	0	147
PAP. BIRCH	1338	0	0	0	0	1338
YEL. BIRCH	45	0	0	0	0	45
COTTONWOOD	0	0	0	0	0	0
ELM	977	0	0	0	0	977
HICKORY	0	0	0	0	0	0
HARD MAPLE	18	0	0	0	0	18
SOFT MAPLE	103	0	0	0	0	103
RED OAK	58	0	0	0	0	58
WHITE OAK	6	0	0	0	0	6
WALNUT	0	0	0	0	0	0
OTHER SPP.	0	0	0	0	0	0
TOTAL HWDS	16560	180	0	0	0	16740
ALL SPECIES	42456	2480	0	0	0	44936

(TABLE 15 CONTINUED ON NEXT PAGE)

(TABLE 15 CONTINUED)

NORTHERN PINE UNIT

SOFTWOODS:						
BALSAM FIR	2356	0	0	0	0	2356
CEDAR	849	0	0	0	0	849
JACK PINE	10654	0	0	0	0	10654
RED PINE	6743	0	0	0	0	6743
WHITE PINE	4801	0	0	0	0	4801
SPRUCE	889	0	0	0	0	889
TAMARACK	176	0	0	0	0	176
TOTAL SWDS	26468	0	0	0	0	26468
HARDWOODS:						
ASH	3827	0	0	0	0	3827
ASPEN	43675	0	0	0	0	43675
BALSAM POP	248	0	0	0	0	248
BASSWOOD	3469	0	0	0	0	3469
PAP. BIRCH	2168	0	0	0	0	2168
YEL. BIRCH	0	0	0	0	0	0
COTTONWOOD	0	0	0	0	0	0
ELM	4942	0	0	0	0	4942
HICKORY	25	0	0	0	0	25
HARD MAPLE	403	0	0	0	0	403
SOFT MAPLE	397	0	0	0	0	397
RED OAK	3137	0	0	0	0	3137
WHITE OAK	1773	0	0	0	0	1773
WALNUT	0	0	0	0	0	0
OTHER SPP.	300	0	0	0	0	300
TOTAL HWDS	64364	0	0	0	0	64364
ALL SPECIES	90832	0	0	0	0	90832

CENTRAL HARDWOODS UNIT

SPECIES	MINNESOTA	WISCONSIN	MISSOURI	IOWA	OTHER STATES	TOTAL
SOFTWOODS:						
BALSAM FIR	4	0	0	0	0	4
CEDAR	5	0	0	0	0	5
JACK PINE	1	0	0	0	0	1
RED PINE	147	0	0	0	0	147
WHITE PINE	153	0	0	0	0	153
SPRUCE	90	0	0	0	0	90
TAMARACK	20	0	0	0	0	20
TOTAL SWDS	420	0	0	0	0	420
HARDWOODS:						
ASH	1250	10	0	0	0	1260
ASPEN	5330	41	0	0	0	5371
BALSAM POP	525	0	0	0	0	525
BASSWOOD	2651	575	0	0	0	3226
PAP. BIRCH	341	7	0	0	0	348
YEL. BIRCH	4	0	0	0	0	4
COTTONWOOD	921	126	0	45	0	1092
ELM	5106	102	0	25	0	5233
HICKORY	92	1	0	0	0	93
HARD MAPLE	926	10	0	0	0	936
SOFT MAPLE	690	100	0	0	0	790
RED OAK	9157	3200	0	18	0	12375
WHITE OAK	2955	260	0	2	0	3217
WALNUT	302	63	178	0	0	543
OTHER SPP.	142	10	0	0	0	152
TOTAL HWDS	30392	4505	178	90	0	35165
ALL SPECIES	30812	4505	178	90	0	35585

(TABLE 15 CONTINUED ON NEXT PAGE)

(TABLE 15 CONTINUED)

PRAIRIE UNIT

SOFTWOODS:						
BALSAM FIR	0	0	0	0	0	0
CEDAR	0	0	0	0	0	0
JACK PINE	0	0	0	0	0	0
RED PINE	0	0	0	0	0	0
WHITE PINE	0	0	0	0	0	0
SPRUCE	149	0	0	0	0	149
TAMARACK	0	0	0	0	0	0
TOTAL SWDS	149	0	0	0	0	149
HARDWOODS:						
ASH	339	0	0	0	0	339
ASPEN	16	0	0	0	0	16
BALSAM POP	0	0	0	0	0	0
BASSWOOD	457	0	0	0	0	457
PAP. BIRCH	39	0	0	0	0	39
YEL. BIRCH	0	0	0	0	0	0
COTTONWOOD	2758	0	0	0	0	2758
ELM	1665	0	0	0	0	1665
HICKORY	0	0	0	0	0	0
HARD MAPLE	74	0	0	0	0	74
SOFT MAPLE	195	0	0	0	0	195
RED OAK	213	0	0	0	0	213
WHITE OAK	230	0	0	0	0	230
WALNUT	15	0	16	0	0	31
OTHER SPP.	2	0	0	0	0	2
TOTAL HWDS	6003	0	16	0	0	6019
ALL SPECIES	6152	0	16	0	0	6168

Table 16.—*Saw log production by unit, county, and species group, Minnesota, 1973*
(In thousand board feet, International ¼-inch rule)

UNIT AND COUNTY	BALSAM FIR	CEDAR	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD	PAPER BIRCH	YELLOW BIRCH	COTTONWOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARDWOODS	ALL SPECIES
NORTHERN ASPEN-BIRCH																							
CARLTON	15	0	0	21	6	1	0	151	169	0	82	53	0	0	97	0	18	13	56	6	0	0	688
COOK	125	150	72	0	2988	1249	0	0	1393	0	0	650	0	0	0	0	0	0	0	0	0	0	6627
KOOCHICHING	701	3164	0	356	198	628	2	643	2543	462	65	329	0	0	880	0	0	90	0	0	0	0	10061
LAKE	1594	0	907	881	1992	985	0	50	1104	0	0	302	45	0	0	0	0	0	0	0	0	0	7860
ST. LOUIS	843	260	1660	4352	4351	695	0	2	6433	1098	0	4	0	0	0	0	0	0	2	0	0	0	19700
UNIT TOTAL	3278	3574	2639	5610	9535	3558	2	846	11642	1560	147	1338	45	0	977	0	18	103	58	6	0	0	44936
NORTHERN PINE																							
AITKIN	11	0	135	269	265	10	0	1635	3284	0	956	315	0	0	1,84	25	241	263	955	222	0	0	9670
BECKER	529	0	614	646	89	14	97	123	854	10	231	162	0	0	375	0	50	0	383	216	0	0	4393
BELTRAMI	90	402	978	888	876	139	10	57	1547	8	508	109	0	0	338	0	0	3	146	19	0	0	6118
CASS	104	10	657	1486	1294	0	0	10	1543	0	190	149	0	0	42	0	0	0	155	5	0	0	5645
CLEARWATER	103	0	2576	679	100	3	2	1375	4301	170	0	1003	0	0	2350	0	0	0	376	251	0	0	13189
CROW WING	0	0	309	665	439	0	10	44	1016	0	313	71	0	0	221	0	103	121	844	173	0	0	4329
HUBBARD	4	0	516	142	125	0	4	0	113	0	0	0	0	0	0	0	0	0	0	0	0	0	904
ITASCA	1480	312	975	1619	1495	567	2	241	29399	30	1180	278	0	0	134	0	0	0	37	1	0	300	38050
LAKE-WOODS	11	125	767	66	99	82	18	25	38	0	0	25	0	0	40	0	0	10	0	0	0	0	1306
MAHNOMEN	0	0	25	50	5	0	23	290	1341	30	40	51	0	0	376	0	0	0	171	839	0	0	3235
ROSEAU	24	0	2698	0	0	74	10	11	116	0	0	0	0	0	0	0	0	0	0	0	0	0	2933
WADENA	0	0	404	233	14	0	0	16	123	0	51	5	0	0	88	0	9	0	70	47	0	0	1060
UNIT TOTAL	2356	849	10654	6743	4801	849	176	3827	43675	248	3469	2168	0	0	4042	25	403	397	3137	1773	0	300	90832
CENTRAL HARDWOODS																							
ANOKA	0	5	0	24	24	30	0	124	2230	525	17	24	0	15	517	0	0	0	60	13	0	0	3608
BENTON	0	0	0	0	0	0	0	1	1	0	9	0	0	0	15	0	13	10	11	8	0	0	68
CARVER	0	0	0	0	0	0	0	9	0	0	92	0	0	7	91	0	45	35	59	43	0	3	384
CHISAGO	0	0	0	1	0	0	0	3	12	0	0	2	0	0	15	0	2	0	30	6	0	0	71
DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	10	20	0	0	0	30	0	0	0	60
DOUGLAS	0	0	0	0	0	0	0	11	27	0	31	2	0	10	21	0	3	0	13	11	1	0	130
FILLMORE	0	0	0	0	0	0	0	8	6	0	171	56	0	28	479	51	155	0	2888	864	107	8	5221
GOODHUE	0	0	0	0	0	60	0	120	140	0	170	40	0	100	700	40	100	220	200	80	80	80	1730
HENNEPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HOUSTON	0	0	0	0	0	0	0	6	45	0	359	5	0	86	227	0	92	0	1637	299	198	2	2955
ISANTI	0	0	0	1	42	0	0	82	24	0	8	0	0	24	50	0	13	19	32	21	0	0	316
KANABEC	0	0	0	0	0	0	0	3	618	0	26	2	0	100	48	0	19	30	287	27	0	0	1160
LE SUEUR	0	0	0	0	0	0	0	102	0	0	260	0	0	65	248	0	109	39	190	45	13	11	1122
MILLE LACS	0	0	0	0	10	0	0	159	1242	0	304	16	0	158	563	0	12	60	745	339	0	11	3619
MORRISON	3	0	3	110	20	0	0	26	575	0	132	28	0	10	292	0	1	29	230	299	1	0	1753
OLMSTEAD	0	0	0	0	1	0	0	2	2	0	9	1	1	7	14	0	5	10	144	34	42	0	272
OTTER TAIL	0	0	1	3	47	0	20	150	180	0	334	53	0	5	411	0	60	0	423	229	0	0	1916
PINE	4	0	0	2	2	0	0	177	99	0	167	32	0	0	213	0	18	23	65	31	0	0	833
RICE	0	0	0	5	0	0	0	36	0	0	102	0	0	68	120	0	59	8	110	77	30	20	635
SCOTT	0	0	0	0	0	0	0	19	0	0	116	0	0	14	119	0	55	39	83	56	0	6	507
SHERBURNE	0	0	0	0	0	0	0	55	0	0	6	0	0	6	23	0	2	33	153	3	0	0	281
STEARNS	0	0	0	0	0	0	0	47	45	0	203	6	0	35	414	0	11	2	85	52	1	0	901
TODD	0	0	0	1	1	0	0	40	61	0	109	22	0	10	276	0	32	43	156	90	0	0	841
WABASHA	0	0	0	0	4	0	0	24	52	0	233	12	2	170	150	2	35	158	2477	268	33	10	3630
WINONA	0	0	0	0	2	0	0	52	8	0	362	47	1	153	190	0	93	32	2265	279	37	1	3522
WRIGHT	0	0	0	0	0	0	0	4	4	0	6	0	0	12	17	0	2	0	2	3	0	0	50
UNIT TOTAL	4	5	1	147	153	90	20	1260	5371	525	3226	348	4	1092	5033	93	936	790	12375	3217	543	152	35585
PRAIRIE																							
BLUE EARTH	0	0	0	0	0	0	0	8	0	0	0	0	0	56	16	0	0	0	0	0	16	0	90
BROWN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
CHIPPEWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	0	0	0	0	0	0	0	111
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	138	0	0	0	0	0	0	0	0	138
FARIBAULT	0	0	0	0	0	0	0	0	0	0	0	0	0	413	0	0	0	0	0	0	0	0	413
KANDIYOHI	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
MCLEOD	0	0	0	0	0	0	0	83	8	0	112	0	0	918	452	0	1	88	33	50	0	0	1945
MARSHALL	0	0	0	0	0	149	0	0	0	0	0	39	0	0	0	0	0	0	0	17	0	0	205
MEEKER	0	0	0	0	0	0	0	84	8	0	61	0	0	432	338	0	0	57	48	60	0	0	1088
NICOLLET	0	0	0	0	0	0	0	45	0	0	124	0	0	35	132	0	52	26	91	41	10	2	558
NORMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	183	0	0	0	0	0	0	0	0	183
PENNINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	20
POLK	0	0	0	0	0	0	0	87	0	0	107	0	0	499	238	0	0	0	0	22	0	0	953
REDWOOD	0	0	0	0	0	0	0	5	0	0	2	0	0	35	5	0	0	5	0	1	0	0	53
RENVILLE	0	0	0	0	0	0	0	5	0	0	1	0	0	30	5	0	0	5	0	1	0	0	47
SIBLEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEELE	0	0	0	0	0	0	0	5	0	0	15	0	0	4	17	0	6	3	16	7	2	0	75
STEVENS	0	0	0	0	0	0	0	5	0	0	0	0	0	10	5	0	0	0	0	0	0	0	20
SWIFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	0	0	0	0	0	0	0	111
WASECA	0	0	0	0	0	0	0	12	0	0	35	0	0	9	35	0	15	5	25	11	3	0	150
UNIT TOTAL	0	0	0	0	0	149	0	339	16	0	457	39	0	2758	1465	0	74	195	213	230	31	2	6168
STATE TOTAL	5438	4428	13294	12500	14489	4686	198	6272	60704	2333	7299	3893	49	3850	12417	118	1431	1485	15783	5226	574	454	177521

Table 17.—*Saw log receipts in Minnesota by unit, species, and State of origin, 1973*

(In thousand board feet, International ¼-inch rule)

SPECIES	ALL STATES	MINNESOTA	WISCONSIN
NORTHERN ASPEN-BIRCH UNIT			
SOFTWOODS:			
BALSAM FIR	1609	1609	0
CEDAR	3338	3338	0
JACK PINE	2609	2609	0
RED PINE	4147	4147	0
WHITE PINE	7750	7406	344
SPRUCE	3915	3915	0
TAMARACK	2	2	0
TOTAL SOFTWOODS	23370	23026	344
HARDWOODS:			
ASH	575	575	0
ASPEN	13769	13769	0
BALSAM POPLAR	2085	2085	0
BASSWOOD	52	52	0
PAPER BIRCH	1265	1265	0
YELLOW BIRCH	45	45	0
ELM	816	816	0
SOFT MAPLE	100	100	0
RED OAK	30	30	0
TOTAL HARDWOODS	18737	18737	0
ALL SPECIES	42107	41763	344
NORTHERN PINE UNIT			
SOFTWOODS:			
BALSAM FIR	2589	2589	—
CEDAR	1085	1085	—
JACK PINE	10355	10355	—
RED PINE	7991	7991	—
WHITE PINE	6607	6607	—
SPRUCE	711	711	—
TAMARACK	176	176	—
TOTAL SOFTWOODS	29514	29514	—
HARDWOODS:			
ASH	3677	3677	—
ASPEN	43285	43285	—
BALSAM POPLAR	248	248	—
BASSWOOD	3111	3111	—
PAPER BIRCH	2178	2178	—
ELM	5244	5244	—
HICKORY	25	25	—
HARD MAPLE	245	245	—
SOFT MAPLE	106	106	—
RED OAK	2986	2986	—
WHITE OAK	1729	1729	—
OTHER SPECIES	300	300	—
TOTAL HARDWOODS	63134	63134	—
ALL SPECIES	92648	92648	—

(Table 17 continued on next page)

(Table 17 continued)

SPECIES	ALL STATES	MINNESOTA	IOWA	WISCONSIN
CENTRAL HARDWOODS UNIT				
SOFTWOODS:				
CEDAR	5	5	0	0
RED PINE	117	117	0	0
WHITE PINE	191	191	0	0
SPRUCE	60	60	0	0
TAMARACK	20	20	0	0
TOTAL SOFTWOODS	393	393	0	0
HARDWOODS:				
ASH	1816	1816	0	0
ASPEN	3415	3409	0	6
BASSWOOD	3462	3379	81	2
PAPER BIRCH	443	443	0	0
YELLOW BIRCH	4	4	0	0
COTTONWOOD	1786	1773	11	2
ELM	5568	5360	208	0
HICKORY	92	92	0	0
HARD MAPLE	1253	1173	80	0
SOFT MAPLE	1011	1011	0	0
RED OAK	10362	9466	876	20
WHITE OAK	3353	3120	233	0
WALNUT	379	317	62	0
OTHER SPECIES	144	144	0	0
TOTAL HARDWOODS	33088	31507	1551	30
ALL SPECIES	33481	31900	1551	30
PRAIRIE UNIT				
HARDWOODS:				
ASH	194	194	—	—
ASPEN	20	20	—	—
BASSWOOD	182	182	—	—
COTTONWOOD	1906	1906	—	—
ELM	1270	1270	—	—
HARD MAPLE	3	3	—	—
SOFT MAPLE	168	168	—	—
RED OAK	83	83	—	—
WHITE OAK	115	115	—	—
TOTAL HARDWOODS	3941	3941	—	—
ALL SPECIES	3941	3941	—	—
ALL UNITS				
SOFTWOODS:				
BALSAM FIR	4198	4198	0	0
CEDAR	4428	4428	0	0
JACK PINE	12964	12964	0	0
RED PINE	12255	12255	0	0
WHITE PINE	14548	14204	0	344
SPRUCE	4686	4686	0	0
TAMARACK	198	198	0	0
TOTAL SOFTWOODS	53277	52933	0	344
HARDWOODS:				
ASH	6262	6262	0	0
ASPEN	60489	60483	0	6
BALSAM POPLAR	2333	2333	0	0
BASSWOOD	6807	6724	81	2
PAPER BIRCH	3886	3886	0	0
YELLOW BIRCH	49	49	0	0
COTTONWOOD	3692	3679	11	2
ELM	12898	12690	208	0
HICKORY	117	117	0	0
HARD MAPLE	1501	1421	80	0
SOFT MAPLE	1385	1385	0	0
RED OAK	13461	12565	876	20
WHITE OAK	5197	4964	233	0
WALNUT	379	317	62	0
OTHER SPECIES	444	444	0	0
TOTAL HARDWOODS	118900	117319	1551	30
ALL SPECIES	172177	170252	1551	374

Table 18.—*Lumber production by unit and county for softwoods and hardwoods, Minnesota, 1973*

(In thousand board feet)

UNIT AND COUNTY	SOFTWOODS	HARDWOODS	ALL SPECIES
CARLTON	63	143	206
COOK	5335	2494	7829
KOOCHICHING	5311	4533	9844
LAKE	5018	1145	6163
ST.LOUIS	8102	10250	18352
NORTHERN ASPEN-BIRCH	23829	18565	42394
AITKIN	1089	7438	8527
BECKER	1172	1120	2292
BELTRAMI	4414	3330	7744
CASS	1870	1490	3360
CLEARWATER	2745	7765	10510
CROW WING	717	402	1119
HUBBARD	1792	711	2503
ITASCA	10935	33431	44366
LAKE OF THE WOODS	802	90	892
MAHNOMEN	170	2540	2710
ROSEAU	3070	155	3225
WADENA	600	3225	3825
NORTHERN PINE	29376	61697	91073
ANOKA	5	345	350
DOUGLAS	0	250	250
FILLMORE	0	4305	4305
GOODHUE	60	1940	2000
HOUSTON	0	4172	4172
ISANTI	0	400	400
KANABEC	0	2000	2000
LE SUEUR	0	2500	2500
MILLE LACS	14	6698	6712
MORRISON	130	375	505
OTTER TAIL	66	655	721
PINE	0	3400	3400
RICE	5	195	200
SCOTT	0	500	500
STEARNS	0	692	692
WABASHA	0	1005	1005
WINONA	0	132	132
WRIGHT	0	100	100
CENTRAL HARDWOODS	280	29664	29944
BLUE EARTH	0	21	21
BROWN	0	80	80
FARIBAULT	0	413	413
KANDIYOHI	0	2	2
MCLEOD	0	3235	3235
MEEKER	0	70	70
REDWOOD	0	100	100
STEVENS	0	20	20
PRAIRIE	0	3941	3941
STATE TOTAL	53485	113867	167352

Table 19.— *Veneer log production and receipts in Minnesota for selected years, 1946-1973*
(In thousand board feet, International 1/4-inch rule)

Year	Production	Receipts
1946	7,995	1,402
1948	7,102	2,296
1950	6,367	1,331
1952	8,051	1,864
1954	10,389	2,214
1956	8,961	1,563
1958	9,031	1,838
1960	10,093	1,062
1962	9,177	2,233
1963	9,970	3,180
1965	7,567	1,077
1966	6,078	511
1968	5,167	482
1970	3,498	390
1972	4,232	482
1973	5,076	495

Table 20.— *Veneer log production and receipts by species in Minnesota, 1960 and 1973*
(In thousand board feet, International 1/4-inch rule)

	Production			Receipts		
Species	1960	1973	Change	1960	1973	Change
Ash	233	10	−223	30	—	−30
Aspen	568	460	−108	2	67	65
Basswood	2,006	673	−1,333	334	171	−163
Paper birch	1,082	271	−811	229	—	−229
Yellow birch	889	18	−871	26	—	−26
Cottonwood	1,278	1,045	−233	292	36	−256
Elm	1,487	315	−1,172	116	—	−116
Hard maple	611	471	−140	1	5	4
Soft maple	578	142	−445	32	190	158
Red oak	1,186	1,521	335	—	26	26
White oak	—	15	15	—	—	—
Walnut	77	56	−21	—	—	—
Other hardwoods	89	79	−10	—	—	—
All species	10,093	5,076	−5,017	1,062	495	−567

Table 21.–Veneer log production by species and State of destination, Minnesota, 1973
(In thousand board feet, International ¼-inch rule)

SPECIES	DESTINATION							
	MINNESOTA	WISCONSIN	MICHIGAN	INDIANA	MISSOURI	IOWA	OTHER STATES	TOTAL
SOFTWOODS:								
BALSAM FIR	0	0	0	0	0	0	0	0
CEDAR	0	0	0	0	0	0	0	0
JACK PINE	0	0	0	0	0	0	0	0
RED PINE	0	0	0	0	0	0	0	0
WHITE PINE	0	0	0	0	0	0	0	0
SPRUCE	0	0	0	0	0	0	0	0
TAMARACK	0	0	0	0	0	0	0	0
TOTAL SWDS	0	0	0	0	0	0	0	0
HARDWOODS:								
ASH	0	10	0	0	0	0	0	10
ASPEN	67	10	383	0	0	0	0	460
BALSAM POP	0	0	0	0	0	0	0	0
BASSWOOD	171	502	0	0	0	0	0	673
PAP. BIRCH	0	202	69	0	0	0	0	271
YEL. BIRCH	0	2	16	0	0	0	0	18
COTTONWOOD	36	1009	0	0	0	0	0	1045
ELM	0	315	0	0	0	0	0	315
HICKORY	0	0	0	0	0	0	0	0
HARD MAPLE	5	466	0	0	0	0	0	471
SOFT MAPLE	61	81	0	0	0	0	0	142
RED OAK	26	1470	0	25	0	0	0	1521
WHITE OAK	0	9	0	6	0	0	0	15
WALNUT	0	0	0	0	56	0	0	56
OTHER SPP.	0	0	0	79	0	0	0	79
TOTAL HWDS	366	4076	468	110	56	0	0	5076
ALL SPECIES	366	4076	468	110	56	0	0	5076

Table 22.—*Veneer log production by unit, county and species, Minnesota, 1973*
(In thousand board feet, International ¼-inch rule)

UNIT AND COUNTY	BALSAM FIR	CEDAR	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD	PAPER BIRCH	YELLOW BIRCH	COTTONWOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARDWOODS	ALL SPECIES
NORTHERN ASPEN-BIRCH																							
CARLTON	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	5
COOK	0	0	0	0	0	0	0	0	0	0	0	29	2	0	0	0	0	0	0	0	0	0	31
KOOCHICHING	0	0	0	0	0	0	0	0	0	0	0	120	0	0	0	0	0	0	0	0	0	0	120
LAKE	0	0	0	0	0	0	0	0	383	0	0	16	16	0	0	0	0	0	0	0	0	0	415
ST. LOUIS	0	0	0	0	0	0	0	0	0	0	29	30	0	0	0	0	0	9	0	0	0	0	68
UNIT TOTAL	0	0	0	0	0	0	0	0	383	0	29	197	18	0	0	0	0	12	0	0	0	0	639
NORTHERN PINE																							
AITKIN	0	0	0	0	0	0	0	0	5	0	56	6	0	0	0	0	0	12	0	0	0	0	79
BECKER	0	0	0	0	0	0	0	0	0	0	59	0	0	0	0	0	0	0	32	0	0	0	91
BELTRAMI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CASS	0	0	0	0	0	0	0	0	0	0	4	8	0	0	0	0	0	2	0	0	0	0	14
CLEARWATER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROW WING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUBBARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITASCA	0	0	0	0	0	0	0	0	0	0	5	28	0	0	0	0	0	2	0	0	0	0	35
LAKE-WOODS	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	32
MAHNOMEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROSEAU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WALENA	0	0	0	0	0	0	0	0	10	0	4	0	0	0	0	0	0	0	3	0	0	0	17
UNIT TOTAL	0	0	0	0	0	0	0	0	15	0	128	74	0	0	0	0	0	16	35	0	0	0	268
CENTRAL HARDWOODS																							
ANOKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BENTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CARVER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHISAGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAKOTA	0	0	0	0	0	0	0	1	0	0	4	0	0	0	6	0	14	21	23	2	0	0	71
DOUGLAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FILLMORE	0	0	0	0	0	0	0	0	0	0	306	0	0	8	0	0	30	0	325	0	4	0	673
GOODHUE	0	0	0	0	0	0	0	0	0	0	7	0	0	180	64	0	258	14	17	2	0	0	542
HENNEPIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HOUSTON	0	0	0	0	0	0	0	0	0	0	0	0	0	109	0	0	31	5	765	0	31	79	1020
ISANTI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KANABEC	0	0	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0	0	5	0	0	0	57
LE SUEUR	0	0	0	0	0	0	0	2	0	0	8	0	0	78	35	0	12	29	17	1	0	0	182
MILLE LACS	0	0	0	0	0	0	0	0	62	0	41	0	0	36	0	0	5	0	21	0	0	0	165
MORRISON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OLMSTEAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	11
OTTER TAIL	0	0	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	0	15	0	0	0	54
PINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RICE	0	0	0	0	0	0	0	1	0	0	5	0	0	8	7	0	27	14	14	1	0	0	77
SCOTT	0	0	0	0	0	0	0	1	0	0	5	0	0	0	7	0	3	6	14	1	0	0	37
SHERBURNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEARNS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TODD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WADENA	0	0	0	0	0	0	0	0	0	0	0	0	0	245	81	0	0	0	134	0	5	0	465
WINONA	0	0	0	0	0	0	0	0	0	0	0	0	0	179	34	0	0	0	107	6	0	0	326
WRIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	0	0	0	0	0	51
UNIT TOTAL	0	0	0	0	0	0	0	5	62	0	467	0	0	843	234	0	431	89	1457	13	51	79	3731
PRAIRIE																							
BLUE EARTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5
BROWN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHIPPEWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FARIBAULT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KANDIYOHI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLEOD	0	0	0	0	0	0	0	1	0	0	5	0	0	0	7	0	3	7	14	1	0	0	38
MARSHALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEEKER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NICOLLET	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NORMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNINGTON	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4
POLK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDWOOD	0	0	0	0	0	0	0	0	0	0	0	0	0	39	13	0	0	0	0	0	0	0	52
RENVILLE	0	0	0	0	0	0	0	0	0	0	0	0	0	40	13	0	0	0	0	0	0	0	53
SIBLEY	0	0	0	0	0	0	0	4	0	0	40	0	0	118	48	0	12	8	15	1	0	0	246
STEELE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	25
STEVENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SWIFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASECA	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	10	0	0	0	0	15
UNIT TOTAL	0	0	0	0	0	0	0	5	0	0	49	0	0	202	81	0	40	25	29	2	5	0	438
STATE TOTAL	0	0	0	0	0	0	0	10	460	0	673	271	18	1045	315	0	471	142	1521	15	56	79	5076

Table 23.—*Pole production by unit, county, and species, Minnesota, 1973*
(In number of pieces)

Unit and county	Cedar	Jack pine	Red pine	Tamarack
Northern Aspen-Birch				
Koochiching	—	284	563	—
Lake	—	4,400	3,660	—
St. Louis	—	11,295	12,273	—
Unit total	—	15,979	16,496	—
Northern pine				
Beltrami	—	8,176	9,850	—
Cass	—	51,471	15,424	—
Clearwater	—	4,691	1,349	—
Crow Wing	—	1,831	789	—
Hubbard	—	7,651	3,970	—
Itasca	200	1,659	1,845	—
Lake of the Woods	750	—	—	300
Roseau	—	—	—	750
Unit total	950	75,497	33,227	1,050
All units	950	91,458	49,723	1,050

Table 24.—*Commercial post production by unit, county, and species, Minnesota, 1973*
(In thousand pieces)

Unit and county	Cedar	Jack pine	Red pine	White pine	Spruce	Tamarack
Northern Aspen-Birch						
Koochiching	74	—	—	—	—	—
St. Louis	4	103	3	—	—	—
Unit total	78	103	3	—	—	—
Northern pine						
Aitkin	—	—	—	—	—	1
Beltrami	13	471	42	10	5	20
Cass	1	200	41	—	—	—
Clearwater	—	14	3	—	—	—
Crow Wing	—	5	1	—	—	—
Hubbard	—	137	3	—	—	—
Itasca	19	3	4	—	—	—
Lake of the Woods	48	—	—	—	—	—
Roseau	—	—	—	—	—	2
Unit total	81	830	94	10	5	23
All units	159	933	97	10	5	23

Table 25.— *Miscellaneous product[1] output by unit, county, and species, Minnesota, 1973*
(In thousand cubic feet)

Unit and county	Balsam fir	Jack pine	Red pine	Ash	Aspen	Balsam poplar	Bass-wood	Paper birch	Elm	Red oak	White oak
NORTHERN ASPEN-BIRCH UNIT											
Carlton	—	—	—	—	41	—	—	8	—	—	—
Koochiching	—	—	1	—	71	—	—	8	—	—	—
Lake	16	—	—	—	98	—	—	649	—	—	—
St. Louis	79	2	13	—	1,419	—	—	121	—	—	—
Unit total	95	2	14	—	1,629	—	—	786	—	—	—
NORTHERN PINE UNIT											
Aitkin	—	—	—	—	191	—	—	12	—	—	—
Beltrami	—	1	2	—	—	—	—	—	—	—	—
Cass	—	43	67	—	119	—	—	—	—	—	—
Clearwater	—	4	7	—	—	—	—	—	—	—	—
Crow Wing	—	1	2	—	—	—	—	—	—	—	—
Hubbard	—	1	4	—	—	—	—	—	—	—	—
Itasca	20	1	6	—	1,670	—	—	78	—	—	—
Lake of the Woods	—	40	—	—	197	—	—	—	—	—	—
Mahnomen	—	—	—	—	—	—	22	—	—	24	—
Wadena	—	—	41	—	235	61	—	—	—	—	—
Unit total	20	91	129	—	2,412	61	22	90	—	24	—
CENTRAL HARDWOOD UNIT											
Douglas	—	—	—	1	2	—	—	—	2	2	—
Fillmore	—	—	—	—	—	—	—	—	—	—	7
Houston	—	—	—	—	—	—	—	—	—	—	13
Isanti	—	—	—	—	—	—	—	—	—	3	—
Kanabec	—	—	—	—	—	—	—	—	—	2	—
Otter Tail	—	—	—	13	355	61	160	8	12	20	—
Pine	—	—	—	—	12	—	—	—	—	—	—
Todd	—	—	—	1	317	82	2	—	2	2	—
Winona	—	—	—	—	—	—	—	—	—	—	10
Unit total	—	—	—	15	686	143	162	8	16	29	30
All Units	115	93	143	15	4,727	204	184	884	16	53	30

[1] Particleboard bolts, piling, shaving bolts, charcoal wood, lath bolts, match bolts, cooperage bolts, and specialty bolts for dowels and nursery flats.

Table 26.—*Residue produced at Minnesota primary wood-using mills by kind of material, type of use, unit, and county, 1973*

(In thousand tons, green weight)

NORTHERN ASPEN-BIRCH UNIT

COUNTY OR UNIT AND TYPE OF USE	WOOD RESIDUE							
	TOTAL		COARSE 1/		FINE 2/		BARK	
	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD
CARLTON								
INDUSTRIAL FUEL	C	0	0	0	0	0	0	4.15
DOMESTIC FUEL	.06	.19	.06	.19	0	0	.02	.08
MISCELLANEOUS 3/	.03	.11	0	0	.03	.11	0	0
NOT USED	.05	0	.03	0	.02	0	.01	0
TOTAL	.14	.30	.09	.19	.05	.11	.03	4.23
COOK								
FIBER PRODUCTS	5.07	1.84	5.07	1.84	0	0	0	0
INDUSTRIAL FUEL	.89	.75	0	0	.89	.75	.43	.16
DOMESTIC FUEL	.02	.25	.02	.25	0	0	0	.01
NOT USED	5.37	2.43	2.07	1.25	3.30	1.18	2.38	1.24
TOTAL	11.35	5.27	7.16	3.34	4.19	1.93	2.81	1.41
KOOCHICHING								
FIBER PRODUCTS	4.58	3.88	3.02	3.68	1.56	.20	0	0
DOMESTIC FUEL	.12	.10	.12	.10	0	0	.04	.04
MISCELLANEOUS 3/	3.25	0	3.25	0	0	0	0	0
NOT USED	3.33	5.64	.73	2.30	2.60	3.34	2.07	2.54
TOTAL	11.28	9.62	7.12	6.08	4.16	3.54	2.11	2.58
LAKE								
FIBER PRODUCTS	6.40	.80	6.40	.80	0	0	0	0
DOMESTIC FUEL	.16	.09	.16	.09	0	0	.04	.05
MISCELLANEOUS 3/	.98	.13	0	0	.98	.13	0	0
NOT USED	3.10	1.41	.17	.64	2.93	.77	2.78	.62
TOTAL	10.64	2.43	6.73	1.53	3.91	.90	2.82	.67
ST.LOUIS								
FIBER PRODUCTS	4.98	2.40	4.98	2.40	0	0	0	0
INDUSTRIAL FUEL	0	.18	0	0	0	.18	.24	1.72
DOMESTIC FUEL	1.61	.25	1.60	.25	.01	0	.62	.09
MISCELLANEOUS 3/	.36	.21	.20	.13	.16	.08	.05	.06
NOT USED	10.24	18.70	4.08	10.97	6.16	7.73	3.64	6.56
TOTAL	17.19	21.74	10.86	13.75	6.33	7.99	4.55	8.43
ALL COUNTIES NORTHERN ASPEN-BIRCH								
FIBER PRODUCTS	21.03	8.92	19.47	8.72	1.56	.20	0	0
INDUSTRIAL FUEL	.89	.93	0	0	.89	.93	.67	6.03
DOMESTIC FUEL	1.97	.88	1.96	.88	.01	0	.72	.27
MISCELLANEOUS 3/	4.62	.45	3.45	.13	1.17	.32	.05	.06
NOT USED	22.09	28.18	7.08	15.16	15.01	13.02	10.88	10.96
TOTAL	50.60	39.36	31.96	24.89	18.64	14.47	12.32	17.32

(TABLE 26 CONTINUED ON NEXT PAGE)

(TABLE 26 CONTINUED) NORTHERN PINE UNIT

COUNTY OR UNIT AND TYPE OF USE	WOOD RESIDUE							
	TOTAL		COARSE 1/		FINE 2/		BARK	
	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD
AITKIN								
FIBER PRODUCTS	.88	3.52	.88	3.52	0	0	0	0
CHARCOAL	0	1.23	0	1.23	0	0	0	.52
DOMESTIC FUEL	.44	3.34	.44	3.34	0	0	.18	1.25
MISCELLANEOUS 3/	.02	.13	0	0	.02	.13	0	0
NOT USED	.96	7.09	.14	1.39	.82	5.70	.45	2.48
TOTAL	2.30	15.31	1.46	9.48	.84	5.83	.63	4.25
BECKER								
DOMESTIC FUEL	.53	1.42	.53	1.37	0	.05	.16	.11
MISCELLANEOUS 3/	.42	.11	0	0	.42	.11	0	0
NOT USED	1.55	.84	1.04	.12	.51	.72	.47	.54
TOTAL	2.50	2.37	1.57	1.49	.93	.88	.63	.65
BELTRAMI								
FIBER PRODUCTS	4.11	1.90	4.11	1.90	0	0	0	0
INDUSTRIAL FUEL	.32	1.90	.32	1.90	0	0	.09	.21
DOMESTIC FUEL	.37	.63	.37	.58	0	.05	.13	.21
MISCELLANEOUS 3/	.17	.33	0	0	.17	.33	.01	0
NOT USED	4.40	2.31	1.11	.08	3.29	2.23	2.43	1.49
TOTAL	9.37	7.07	5.91	4.46	3.46	2.61	2.66	1.91
CASS								
INDUSTRIAL FUEL	.04	.09	.04	.09	0	0	1.61	.04
DOMESTIC FUEL	.13	.05	.13	.05	0	0	.67	.02
MISCELLANEOUS 3/	.40	0	.40	0	0	0	.17	0
NOT USED	3.38	3.00	1.93	1.85	1.45	1.15	3.01	.79
TOTAL	3.95	3.14	2.50	1.99	1.45	1.15	5.46	.85
CLEARWATER								
FIBER PRODUCTS	2.70	5.61	2.70	5.61	0	0	0	0
DOMESTIC FUEL	.05	.07	.05	.07	0	0	.02	.03
MISCELLANEOUS 3/	.03	.04	0	0	.03	.04	0	0
NOT USED	3.04	10.74	.93	4.72	2.11	6.02	1.54	4.39
TOTAL	5.82	16.46	3.68	10.40	2.14	6.06	1.56	4.42
CROW WING								
DOMESTIC FUEL	.30	.09	.30	.09	0	0	.12	.03
MISCELLANEOUS 3/	.01	0	0	0	.01	0	0	0
NOT USED	1.22	.77	.66	.45	.56	.32	.28	.19
TOTAL	1.53	.86	.96	.54	.57	.32	.40	.22
HUBBARD								
DOMESTIC FUEL	.55	.09	.55	.09	0	0	.24	.05
MISCELLANEOUS 3/	.19	.03	.01	.01	.18	.02	0	0
NOT USED	3.02	1.37	1.81	.84	1.21	.53	1.02	.36
TOTAL	3.76	1.49	2.37	.94	1.39	.55	1.26	.41
ITASCA								
FIBER PRODUCTS	10.93	40.29	10.93	36.29	0	4.00	0	.17
DOMESTIC FUEL	.78	2.36	.78	2.36	0	0	.32	1.02
MISCELLANEOUS 3/	3.07	2.89	.41	.79	2.66	2.10	0	0
NOT USED	8.41	27.97	2.55	8.01	5.86	19.96	5.48	17.89
TOTAL	23.19	73.51	14.67	47.45	8.52	26.06	5.80	19.08
LAKE OF THE WOODS								
DOMESTIC FUEL	.15	.06	.15	.06	0	0	.04	.03
MISCELLANEOUS 3/	.03	0	0	0	.03	0	0	0
NOT USED	1.51	.13	.92	.06	.59	.07	.39	.03
TOTAL	1.69	.19	1.07	.12	.62	.07	.43	.06
MAHNOMEN								
DOMESTIC FUEL	.03	.41	.03	.41	0	0	.01	.12
MISCELLANEOUS 3/	0	.01	0	0	0	.01	0	0
NOT USED	.32	5.59	.20	3.12	.12	2.47	.09	1.51
TOTAL	.35	6.01	.23	3.53	.12	2.48	.10	1.63
ROSEAU								
FIBER PRODUCTS	.05	.03	.05	.03	0	0	0	0
DOMESTIC FUEL	1.71	0	1.26	0	.45	0	.51	0
MISCELLANEOUS 3/	.31	0	0	0	.31	0	.23	0
NOT USED	4.48	.31	2.82	.19	1.66	.12	1.09	.09
TOTAL	6.55	.34	4.13	.22	2.42	.12	1.83	.09
WADENA								
DOMESTIC FUEL	.20	.40	.20	.40	0	0	.09	.17
MISCELLANEOUS 3/	.06	0	0	0	.06	0	0	0
NOT USED	1.06	6.56	.62	3.99	.44	2.57	.27	1.69
TOTAL	1.32	6.96	.82	4.39	.50	2.57	.36	1.86

(TABLE 26 CONTINUED ON NEXT PAGE)

(TABLE 26 CONTINUED) NORTHERN PINE UNIT (continued)

COUNTY OR UNIT AND TYPE OF USE	WOOD RESIDUE							
	TOTAL		COARSE 1/		FINE 2/		BARK	
	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD
ALL COUNTIES NORTHERN PINE								
FIBER PRODUCTS	18.67	51.35	18.67	47.35	0	4.00	0	.17
CHARCOAL	0	1.23	0	1.23	0	0	0	.52
INDUSTRIAL FUEL	.36	1.99	.36	1.99	0	0	1.70	.25
DOMESTIC FUEL	5.24	8.92	4.79	8.82	.45	.10	2.49	3.04
MISCELLANEOUS 3/	4.71	3.54	.82	.80	3.89	2.74	.41	0
NOT USED	33.35	66.68	14.73	24.82	18.62	41.86	16.52	31.45
TOTAL	62.33	133.71	39.37	85.01	22.96	48.70	21.12	35.43
CENTRAL HARDWOODS UNIT								
ANOKA								
DOMESTIC FUEL	.01	.73	.01	.46	0	.27	0	.20
TOTAL	.01	.73	.01	.46	0	.27	0	.20
DOUGLAS								
DOMESTIC FUEL	0	.25	0	.25	0	0	0	.07
MISCELLANEOUS 3/	0	.08	0	.04	0	.04	0	0
NOT USED	0	.22	0	.06	0	.16	0	.08
TOTAL	0	.55	0	.35	0	.20	0	.15
FILLMORE								
FIBER PRODUCTS	0	5.30	0	5.30	0	0	0	0
DOMESTIC FUEL	0	.39	0	.39	0	0	0	.03
MISCELLANEOUS 3/	0	.57	0	0	0	.57	0	.19
NOT USED	0	2.84	0	.06	0	2.78	0	2.23
TOTAL	0	9.10	0	5.75	0	3.35	0	2.45
GOODHUE								
CHARCOAL	0	1.56	0	1.56	0	0	0	.66
DOMESTIC FUEL	0	.26	0	.26	0	0	0	.11
MISCELLANEOUS 3/	0	1.50	0	0	0	1.50	0	0
NOT USED	.13	.80	.08	.78	.05	.02	.02	.33
TOTAL	.13	4.12	.08	2.60	.05	1.52	.02	1.10
HOUSTON								
FIBER PRODUCTS	0	5.27	0	5.27	0	0	0	0
DOMESTIC FUEL	0	3.05	0	.98	0	2.07	0	.35
MISCELLANEOUS 3/	0	1.72	0	0	0	1.72	0	.17
NOT USED	0	1.85	0	.60	0	1.25	0	2.58
TOTAL	0	11.89	0	6.85	0	5.04	0	3.10
ISANTI								
NOT USED	0	.85	0	.54	0	.31	0	.23
TOTAL	0	.85	0	.54	0	.31	0	.23
KANABEC								
CHARCOAL	0	2.68	0	2.68	0	0	0	1.14
DOMESTIC FUEL	0	1.56	0	0	0	1.56	0	0
TOTAL	0	4.24	0	2.68	0	1.56	0	1.14
LE SUEUR								
DOMESTIC FUEL	0	2.81	0	2.81	0	0	0	.34
MISCELLANEOUS 3/	0	1.72	0	0	0	1.72	0	.17
NOT USED	0	.77	0	.54	0	.23	0	.91
TOTAL	0	5.30	0	3.35	0	1.95	0	1.42
MILLE LACS								
FIBER PRODUCTS	.15	9.31	.15	9.31	0	0	0	0
INDUSTRIAL FUEL	0	.06	0	.06	0	0	0	.05
DOMESTIC FUEL	.01	.22	.01	.21	0	.01	0	.15
MISCELLANEOUS 3/	.07	4.06	0	0	.07	4.06	0	0
NOT USED	.02	1.76	0	0	.02	1.76	.06	3.96
TOTAL	.25	15.41	.16	9.58	.09	5.83	.06	4.16
MORRISON								
DOMESTIC FUEL	0	.04	0	.04	0	0	0	.01
MISCELLANEOUS 3/	0	0	0	0	0	0	0	0
NOT USED	.27	.76	.16	.47	.11	.29	.08	.20
TOTAL	.27	.80	.16	.51	.11	.29	.08	.21
OTTER TAIL								
DOMESTIC FUEL	.02	.24	.02	.24	0	0	.01	.10
MISCELLANEOUS 3/	.01	.27	.01	.03	0	.24	0	.01
NOT USED	.11	.86	.06	.60	.05	.26	.03	.82
TOTAL	.14	1.37	.09	.87	.05	.50	.04	.93
PINE								
FIBER PRODUCTS	0	4.56	0	4.56	0	0	0	0
NOT USED	0	2.65	0	0	0	2.65	0	1.94
TOTAL	0	7.21	0	4.56	0	2.65	0	1.94

(TABLE 26 CONTINUED ON NEXT PAGE)

(TABLE 26 CONTINUED) CENTRAL HARDWOODS UNIT (continued)

COUNTY OR UNIT AND TYPE OF USE	WOOD RESIDUE						BARK	
	TOTAL		COARSE 1/		FINE 2/			
	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD
RICE								
DOMESTIC FUEL	0	.07	0	.07	0	0	0	.03
MISCELLANEOUS 3/	0	0	0	0	0	0	0	0
NOT USED	.01	.20	.01	.20	0	0	0	.08
TOTAL	.01	.27	.01	.27	0	0	0	.11
SCOTT								
DOMESTIC FUEL	0	.67	0	.67	0	0	0	.29
MISCELLANEOUS 3/	0	.39	0	0	0	.39	0	0
TOTAL	0	1.06	0	.67	0	.39	0	.29
STEARNS								
DOMESTIC FUEL	0	1.07	0	.93	0	.14	0	.10
MISCELLANEOUS 3/	0	.40	0	0	0	.40	0	0
NOT USED	0	0	0	0	0	0	0	.29
TOTAL	0	1.47	0	.93	0	.54	0	.39
WABASHA								
FIBER PRODUCTS	0	1.21	0	1.21	0	0	0	0
DOMESTIC FUEL	0	.14	0	.14	0	0	0	0
MISCELLANEOUS 3/	0	.62	0	0	0	.62	0	.17
NOT USED	0	.16	0	0	0	.16	0	.40
TOTAL	0	2.13	0	1.35	0	.78	0	.57
WINONA								
FIBER PRODUCTS	0	3.34	0	3.34	0	0	0	0
DOMESTIC FUEL	0	.18	0	.18	0	0	0	0
MISCELLANEOUS 3/	0	.19	0	0	0	.19	0	0
NOT USED	0	1.85	0	0	0	1.85	0	1.49
TOTAL	0	5.56	0	3.52	0	2.04	0	1.49
WRIGHT								
INDUSTRIAL FUEL	0	.07	0	.02	0	.05	0	.01
DOMESTIC FUEL	0	.21	0	.19	0	.02	0	.05
MISCELLANEOUS 3/	0	.10	0	0	0	.10	0	0
NOT USED	0	.05	0	0	0	.05	0	.06
TOTAL	0	.43	0	.21	0	.22	0	.12
ALL COUNTIES CENTRAL HARDWOODS								
FIBER PRODUCTS	.15	28.99	.15	28.99	0	0	0	0
CHARCOAL	0	4.24	0	4.24	0	0	0	1.80
INDUSTRIAL FUEL	0	.13	0	.08	0	.05	0	.06
DOMESTIC FUEL	.04	11.89	.04	7.82	0	4.07	.01	1.83
MISCELLANEOUS 3/	.08	11.62	.01	.07	.07	11.55	0	.71
NOT USED	.54	15.62	.31	3.85	.23	11.77	.19	15.60
TOTAL	.81	72.49	.51	45.05	.30	27.44	.20	20.00

(TABLE 26 CONTINUED ON NEXT PAGE)

(TABLE 26 CONTINUED)

PRAIRIE UNIT

COUNTY OR UNIT AND TYPE OF USE	WOOD RESIDUE						BARK	
	TOTAL		COARSE 1/		FINE 2/			
	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD	SOFTWOOD	HARDWOOD
BLUE EARTH								
MISCELLANEOUS 3/	0	.01	0	0	0	.01	0	0
NOT USED	0	.04	0	.03	0	.01	0	.01
TOTAL	0	.05	0	.03	0	.02	0	.01
BROWN								
DOMESTIC FUEL	0	.11	0	.11	0	0	0	.05
MISCELLANEOUS 3/	0	.06	0	0	0	.06	0	0
TOTAL	0	.17	0	.11	0	.06	0	.05
FARIBAULT								
DOMESTIC FUEL	0	.71	0	.55	0	.16	0	.24
NOT USED	0	.16	0	0	0	.16	0	0
TOTAL	0	.87	0	.55	0	.32	0	.24
KANDIYOHI								
NOT USED	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0
MCLEOD								
DOMESTIC FUEL	0	3.53	0	3.53	0	0	0	1.51
MISCELLANEOUS 3/	0	1.33	0	0	0	1.33	0	0
NOT USED	0	1.99	0	.80	0	1.19	0	.34
TOTAL	0	6.85	0	4.33	0	2.52	0	1.85
MEEKER								
DOMESTIC FUEL	0	.05	0	.05	0	0	0	.02
MISCELLANEOUS 3/	0	.01	0	0	0	.01	0	0
NOT USED	0	.09	0	.05	0	.04	0	.02
TOTAL	0	.15	0	.10	0	.05	0	.04
REDWOOD								
DOMESTIC FUEL	0	.05	0	.05	0	0	0	.02
MISCELLANEOUS 3/	0	.01	0	0	0	.01	0	0
NOT USED	0	.15	0	.08	0	.07	0	.03
TOTAL	0	.21	0	.13	0	.08	0	.05
SIBLEY								
DOMESTIC FUEL	0	.01	0	.01	0	0	0	.02
MISCELLANEOUS 3/	0	.12	0	.04	0	.08	0	.02
TOTAL	0	.13	0	.05	0	.08	0	.04
STEVENS								
DOMESTIC FUEL	0	.01	0	.01	0	0	0	0
MISCELLANEOUS 3/	0	0	0	0	0	0	0	0
NOT USED	0	.03	0	.02	0	.01	0	.01
TOTAL	0	.04	0	.03	0	.01	0	.01
ALL COUNTIES PRAIRIE								
DOMESTIC FUEL	0	4.47	0	4.31	0	.16	0	1.86
MISCELLANEOUS 3/	0	1.54	0	.04	0	1.50	0	.02
NOT USED	0	2.46	0	.98	0	1.48	0	.41
TOTAL	0	8.47	0	5.33	0	3.14	0	2.29
ALL UNITS								
TOTAL MINNESOTA								
FIBER PRODUCTS	39.85	89.26	38.29	85.06	1.56	4.20	0	.17
CHARCOAL	0	5.47	0	5.47	0	0	0	2.32
INDUSTRIAL FUEL	1.25	3.05	.36	2.07	.89	.98	2.37	6.34
DOMESTIC FUEL	7.25	26.16	6.79	21.83	.46	4.33	3.22	7.00
MISCELLANEOUS 3/	9.41	17.15	4.28	1.04	5.13	16.11	.46	.79
NOT USED	55.98	112.94	22.12	44.81	33.86	68.13	27.59	58.42
TOTAL	113.74	254.03	71.84	160.28	41.90	93.75	33.64	75.04

1/ SUITABLE FOR CHIPPING SUCH AS SLABS, EDGINGS, VENEER CORES, ETC.
2/ NOT SUITABLE FOR CHIPPING SUCH AS SAWDUST, VENEER CLIPPINGS, ETC.
3/ LIVESTOCK BEDDING, MULCH, SMALL DIMENSION, AND SPECIALTY ITEMS.

☆U.S. GOVERNMENT PRINTING OFFICE: 1979--666983/317

Blyth, James E., Steven Wilhelm, and Jerold T. Hahn.
1979. Primary forest products industry and timber use, Minnesota, 1973. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-39, 34 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Discusses recent Minnesota forest industry trends; timber removals for industrial roundwood in 1973; production and receipts in 1973 of pulpwood, saw logs, and other industrial roundwood products. Shows trends in pulpwood and veneer log production and compares saw log production in 1960 and 1973. Discusses primary wood-using mill residue and its disposition.

OXFORD: 792:791(776). KEY WORDS: pulpwood, saw logs, production, trends, wood residue, timber removals.

Blyth, James E., Steven Wilhelm, and Jerold T. Hahn.
1979. Primary forest products industry and timber use, Minnesota, 1973. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-39, 34 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Discusses recent Minnesota forest industry trends; timber removals for industrial roundwood in 1973; production and receipts in 1973 of pulpwood, saw logs, and other industrial roundwood products. Shows trends in pulpwood and veneer log production and compares saw log production in 1960 and 1973. Discusses primary wood-using mill residue and its disposition.

OXFORD: 792:791(776). KEY WORDS: pulpwood, saw logs, production, trends, wood residue, timber removals.

Sing along with Woodsy and help stop pollution.

USDA FOREST SERVICE
RESOURCE BULLETIN NC-40

GOVT. DOCUMENTS
DEPOSITORY ITEM

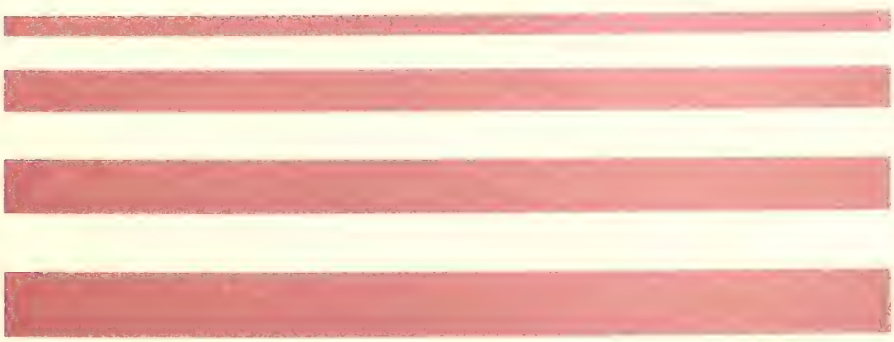
OCT 25 1979

CLEMSON
LIBRARY

CLEMSON UNIVERSITY LIBRARY
OCT 26 1979
DOCS DIV.

Land-Use Change in Missouri, 1959-1972

Pamela J. Jakes
John S. Spencer, Jr.
Burton L. Essex



North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication December 14, 1978
1979

LAND-USE CHANGE IN MISSOURI, 1959-1972

Pamela J. Jakes, *Associate Resource Analyst,*
John S. Spencer, Jr., *Resource Analyst,*
and **Burton L. Essex,** *Principal Resource Analyst*

Between 1959 and 1972, the area of commercial forest land[1] in Missouri declined 11 percent. This decline has caused concern among citizens of the State who question the wisdom of converting large areas of commercial forest land to nonforest uses. This concern frequently focuses on the following questions:

1. What is the magnitude and direction of land-use change in Missouri?
2. Which areas of the State have been most affected by land-use change?
3. What is the site quality of areas removed from the commercial forest land base?
4. Which forest types have been affected by land-use change?
5. What happened to lands that remained commercial forest land between 1959 and 1972?

By analyzing data collected from remeasurement of permanent sample plots during Missouri's third Forest Survey (1972)[2], and comparing this data to that collected on the same plots from Missouri's second Forest Survey (1959), these questions can be answered.

[1]*Commercial forest land is forest land that is producing or is capable of producing crops of industrial wood, and that is not withdrawn from timber utilization by statute or administrative regulation. Other terms are defined in the Appendix.*

[2]*Additional information from Missouri's third Forest Survey is published in the State Report, Timber in Missouri, 1972 (Resource Bulletin NC-30), and five Survey Unit reports, Timber Resource of Missouri's Eastern Ozarks (Resource Bulletin NC-19), Timber Resource of Missouri's Southwestern Ozarks (Resource Bulletin NC-21), Timber Resource of Missouri's Northwestern Ozarks (Resource Bulletin NC-22), Timber Resource of Missouri's Prairie Region (Resource Bulletin NC-26), and Timber Resource of Missouri's Riverborder Region (Resource Bulletin NC-25).*

WHAT IS THE MAGNITUDE AND DIRECTION OF LAND-USE CHANGE IN MISSOURI BETWEEN 1959 AND 1972?

Most shifts in land use are the result of man-initiated actions. Forests are cleared, homes are built, crops are planted, wetlands are drained, and legislative action transfers commercial forest land to productive-reserved status. In a few cases, land use changes occur naturally. Forest encroaches on abandoned farmland as tree stocking increases, so the land is placed in one of the forest land use categories.

Shifts in land use in Missouri between 1959 and 1972 occurred among all three land classes. Changes in land use resulted in an 11 percent reduction in the area of commercial forest land, a 4 percent increase in the area of nonforest land, and a 24 percent increase in the area of noncommercial forest land (table 1).

Table 1.—*Area of land by land class, Missouri 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	13,818.3	12,364.7	−10.5
noncommercial forest			
productive-reserved	90.3	256.1	+183.6
unproductive	357.8	298.3	−16.6
subtotal	14,266.4	12,919.1	−9.4
Nonforest land	30,038.2	31,270.2	+4.1
Total land	44,304.6	44,189.3	−0.3

Commercial Forest Area Declines

Of the 13.8 million acres of land classified as commercial forest in 1959, 1.7 million acres were converted to nonforest uses by 1972 (table 13, Appendix).

Commercial forest acreage was converted to nonforest uses between 1959 and 1972 as follows:

Nonforest land use	Area
	(acres)
Pasture	1,332,100
Cropland	230,000
Rights-of-way	84,800
Urban	36,400
Recreation	33,100
Other	30,400
Total	1,746,800

Most of the commercial forest land was converted to pasture; more than 72 percent of the new pasture is classified as wooded pasture. This land is sufficiently stocked with trees to be classed as forest land, but the present highest use is forage production for livestock. If, in the future, livestock were removed from the land, it would be reclassified as forest land.

Herbicides were used to convert 166,200 acres of commercial forest land to pasture. The remaining 1.2 million acres of new pasture were created by simply changing land use (as in the case of wooded pasture) or by altering cover vegetation through cutting, burning or bulldozing.

The volume of growing stock on the land converted to nonforest uses was 626.6 million cubic feet in 1959. If this land had remained in timber production, and if the volume had increased at the same rate as the remaining forest stands in the State (0.4 percent of inventory volume per year); there would have been an additional 657.8 million cubic feet of growing-stock inventory in 1972. This additional volume would increase the reported 1972 inventory volume by 11 percent. Furthermore, if timber removals from the converted land had occurred at the same rate as removals in 1972 (3 percent of inventory), removals for 1972 would have increased by 19.7 million cubic feet (12 percent).

Between 1959 and 1972, 391,200 acres of nonforest land were returned to commercial forest land through natural regeneration of forest trees. Much of the natural regeneration occurred on land classified as cropland or pasture in 1959 but which became sufficiently stocked with trees by 1972 to be classified as commercial forest land. The increase in growing-stock volume on commercial forest land due to the addition of nonforest land to the forest land base is slight—about 38 million cubic feet. One reason for the low volume increase is that the trees on the new commercial forest land are primarily seedlings and saplings, representing no inventory volume. The removal of land from the commercial forest base causes an immediate reduction in available merchantable wood volume, while increases in commercial forest acreage may not produce merchantable volumes for 20 to 30 years. A second reason for low volume on land reverting to forest is that 30 percent of this new commercial forest land is classified as nonstocked, with stocking of trees less than 16.7 percent.

An additional 67,800 acres of commercial forest land were found on sites classified as unproductive in 1959. Most of this increase in commercial forest is the result of formerly unproductive land being drained sufficiently by 1972 to be reclassified. Sixty-one percent of this change occurred in the Northwestern Ozarks.

As a result of these changes in land use, commercial forest area declined from 13.8 million acres in 1959 to 12.4 million acres in 1972.

Noncommercial Forest Areas Increase by 24 Percent

The area of noncommercial forest land increased from 448,100 acres in 1959 to 554,400 acres in 1972 (table 14). This increase was the result of commercial forest land being placed under productive-reserved status (165,800 acres) and nonforest land reverting to unproductive forest (29,000 acres).

Nonforest Land Increases in Area by 4 Percent

The area of nonforest land increased in Missouri from 30.0 million acres in 1959 to 31.3 million acres in 1972. The increase in nonforest area was due primarily to commercial forest land being converted to nonforest uses (as discussed in detail above), however, additional increases in nonforest area were the result of unproductive forest land being converted to urban uses (7,200 acres) and pasture (13,500 acres).

WHICH AREAS OF THE STATE HAVE BEEN MOST AFFECTED BY LAND USE CHANGE?

Commercial forests do not occur uniformly across Missouri, but vary by Forest Survey Unit (fig. 1). One-third of the commercial forest land in the State lies in the Eastern Ozarks which contains only 14 percent of the total land area of the State (fig. 2). The three Ozark units together account for 67 percent of the total commercial forest land in Missouri. The Northern Prairie Unit contains 37 percent of the nonforest acreage (most of which is cropland), and the Southern Prairie Unit includes the next largest percentage of nonforest land (19 percent). Just as the forest area varies by region, land-use change also varied.

The Missouri Ozarks

Unit 1–Eastern Ozarks

The Eastern Ozarks Unit is an important source of wood fiber for Missouri's forest products industries. In 1969, the Eastern Ozarks supplied one-half of the total saw log volume harvested in the State and one-fourth of the total cooperage volume harvested[3]. The Unit contains a large portion of the State's commercially valuable oak types. Over 42 percent of the State's black-scarlet oak acreage occurs in the region as does 32 percent of the white oak area. Shifts in land use are of importance

[3]*Blyth, James E., and Robert Massengale. 1972. Missouri's primary forest products output and industries 1969. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-16, 15 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.*

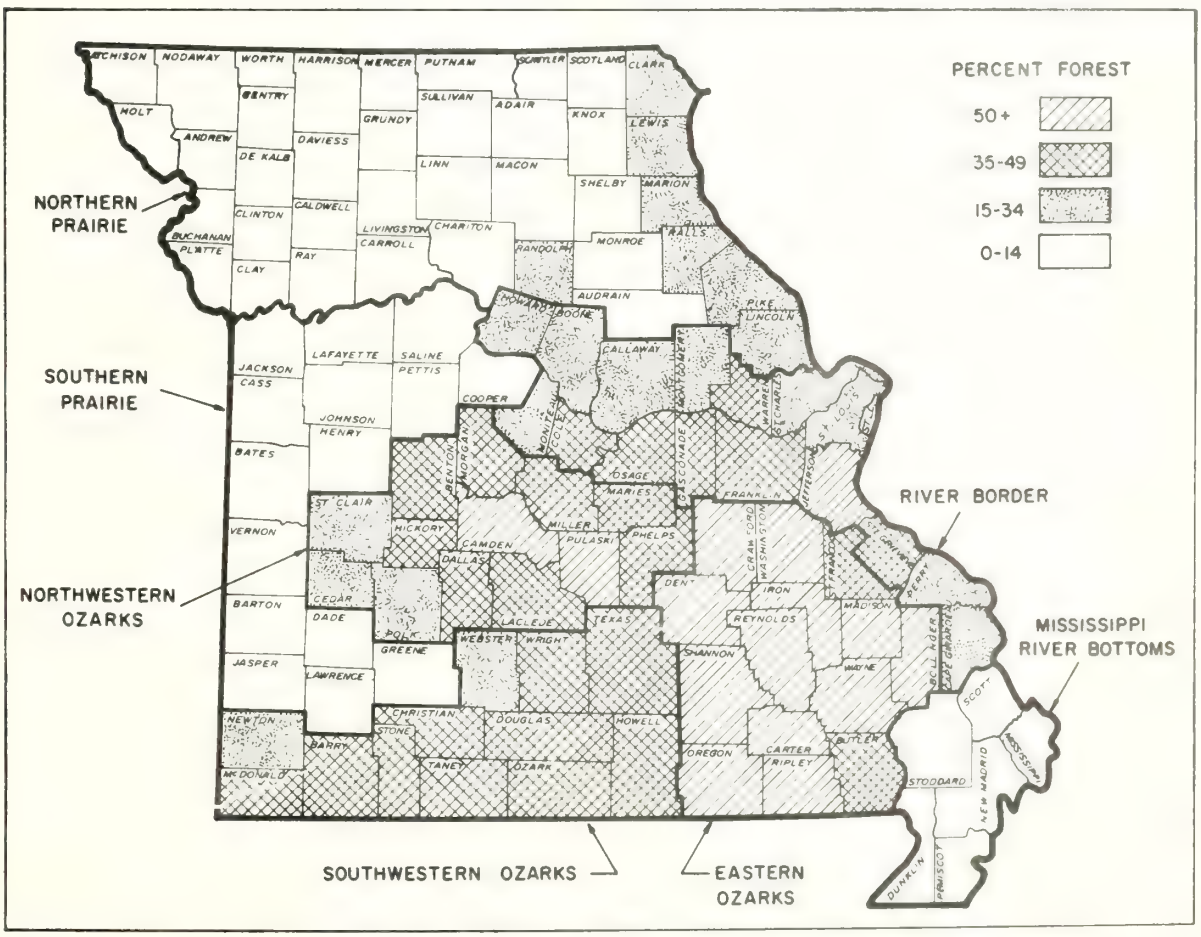


Figure 1.—*Commercial forest area as a percent of land area, by county, Missouri, 1972.*

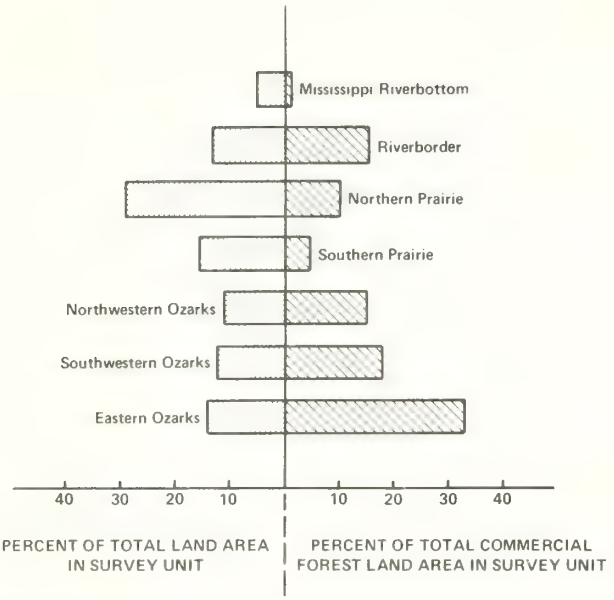


Figure 2.—*Distribution of total land area and commercial forest area among Survey Units, Missouri, 1972.*

because of the possible effects these shifts may have on future timber supplies (table 2). Of the 4.3 million acres of commercial forest in the Unit in 1959, 286,100 acres were converted to other uses by 1972 (table 15, Appendix). The largest amount of commercial forest was lost to pasture by means other than herbicide application (111,600 acres). Many commercial forest acres (70,800 acres) were also placed under productive-reserved status. The 24,000 acres of commercial forest converted to rights-of-way in the Unit is 28 percent of the State total.

Table 2.—*Area by land class, Eastern Ozarks Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	4,259.4	4,084.0	−4.1
noncommercial forest			
productive-reserved	26.5	97.3	+267.2
unproductive	71.9	63.3	−12.0
subtotal	4,357.8	4,244.6	−2.6
Nonforest land	1,792.0	1,918.3	+7.0
Total land	6,149.8	6,162.9	+0.2

The growing-stock volume on land converted to nonforest uses was 87 million cubic feet in 1959. If this volume had grown at the same rate as the State average between 1959 and 1972, it would represent 91.3 million cubic feet in 1972. As with area, most of the volume loss occurred on land converted to pasture by means other than herbicides (45 million cubic feet).

Areas returned to commercial forest land from noncommercial forest land by physiographic changes (16,300 acres), and from nonforest land by natural reversion (94,400 acres) were not enough to offset shifts from commercial forest land to other uses, resulting in a net decrease of 175,400 acres in commercial forest land.

Further shifts in land use in the Eastern Ozarks resulted in an increase in the area of noncommercial forest land and nonforest land. From 1959 to 1972 the area of noncommercial forest land increased 62,200 thousand acres while the area of nonforest land increased 126,300 acres. Most of the noncommercial forest land increase occurred in productive-reserved, the largest increase among nonforest land uses occurred in pasture.

Unit 2–Southwestern Ozarks

The area of commercial forest land in the Southwestern Ozarks declined 504,000 acres between surveys, from 2.8 million acres in 1959 to 2.3 million acres in 1972 (table 3). The Unit lost more acreage from its commercial forest base than any other Unit. This decline in commercial forest acreage is important not only because of the magnitude of the change, but also because the loss occurred in a Unit that is a major source of wood fiber for Missouri's wood products industries. In 1969, one-fifth of the total saw log volume harvested in the State came from this area.[3]

Of the 2.8 million acres of commercial forest land reported in the Southwestern Ozarks in 1959, 557,100 acres (20 percent) were converted to other uses by 1972 (table 16, Appendix). There were 133.3 million cubic feet of growing-stock inventory on the converted land in 1959. By projecting the 1959 volume to 1972 using the average annual increase in volume for that period, the 133.3 mil-

Table 3.—*Area by land class, Southwestern Ozarks Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	2,815.4	2,311.4	−17.9
noncommercial forest			
productive-reserved	17.6	22.6	+28.4
unproductive	121.2	109.3	−9.8
subtotal	2,954.2	2,443.3	−17.3
Nonforest land	2,573.5	2,997.0	+16.5
Total land	5,527.7	5,440.3	−1.6

Table 4.—*Area by land class, Northwestern Ozarks Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	2,146.3	1,920.0	−10.5
noncommercial forest			
productive-reserved	14.7	73.6	+400.7
unproductive	116.6	77.4	−33.6
subtotal	2,277.6	2,071.0	−9.1
Nonforest land	2,780.9	2,958.5	+6.4
Total land	5,058.5	5,029.5	−0.6

lion cubic feet grows to 139.9 million cubic feet. This additional inventory would have resulted in a 16 percent increase in the Unit's 1972 growing stock volume.

Most of the commercial forest land lost to other uses was converted to pasture. Of the total Missouri commercial forest land acreage converted to pasture between surveys, one-third was converted in the Southwestern Ozarks. The remaining 43,800 acres of commerical forest land converted to other uses between surveys went to rights-of-way, cropland, urban development, productive-reserved, and other uses.

Noncommercial and nonforest lands changed to commercial forest land as a result of physiographic change and natural reversion. These additions to the commercial forest land base were offset by the diversion of commercial forest land to other uses (mentioned above), resulting in a net loss of 504,000 acres of commercial forest land.

The area of noncommercial forest land in the Southwestern Ozarks decreased from 138,800 acres in 1959 to 131,900 acres in 1972. Nonforest land area increased from 2.6 million acres in 1959 to 3.0 million acres in 1972, mainly from increases in the area of pasture.

Unit 3–Northwestern Ozarks

Fifteen percent of the 2.1 million acres of commercial forest land in the Northwestern Ozarks in 1959 was converted to nonforest or noncommercial forest uses by 1972 (table 4). In 1959, 70.2 million cubic feet of growing stock trees occupied forest land that was later converted to other uses. This volume would have grown to an estimated 73.7 million cubic feet by 1972, increasing the Unit's growing stock inventory in that year by 11 percent (table 17, Appendix).

Again, the creation of pasture accounted for the largest percentage of commercial forest land lost in the Unit between surveys; 260,400 acres of land previously classified as commercial forest land were converted to pasture by 1972. The Northwestern Ozarks accounted for over 40 percent of the total commercial forest land converted to pasture through the use of herbicides in the State.

The area of noncommercial forest land in the Northwestern Ozarks increased from 131,300 acres in 1959 to 151,000 acres in 1972. This increase was brought about by the transfer of commercial forest land to productive-reserved, and the reversion of nonforest land to unproductive forest land. The area of nonforest land also increased between surveys, from 2.8 million acres to 3.0 million acres.

The Prairie Units

Unit 4–Southern Prairie Unit

In 1959 there were 742,300 acres of commercial forest land in Missouri's Southern Prairie Unit; by 1972 this area had been reduced to 621,100 acres (table 5). Growing-stock volume on the 158,100 acres of forest land converted to other uses totaled 39.1 million cubic feet in 1959, and could have grown to 41.1 million cubic feet in 1972. Over 20 percent of the area classified as commercial forest land in 1959 was reclassified as pasture, productive-reserved and cropland (table 18, Appendix).

Table 5.—*Area by land class, Southern Prairie Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	742.3	621.1	−16.3
noncommercial forest			
productive-reserved	3.7	34.8	+840.5
unproductive	4.5	4.5	0
subtotal	750.5	660.4	−12.0
Nonforest land	5,786.5	5,872.4	+1.5
Total land	6,537.0	6,532.8	−0.1

Table 6.—*Area by land class, Northern Prairie Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	1,666.5	1,319.3	−20.8
noncommercial forest			
productive-reserved	11.7	11.7	0
unproductive	11.4	11.4	0
subtotal	1,689.6	1,342.4	−20.5
Nonforest land	11,330.5	11,673.1	+3.0
Total land	13,020.1	13,015.5	(1)

[1]Less than 0.1 percent.

Acreage converted to commercial forest land in the Southern Prairies by natural reversion of nonforest land was not enough to offset losses from the commercial forest land base, resulting in a net decrease of 121,200 acres in commercial forest.

The area of noncommercial forest land increased 31,100 acres from 1959 to 1972; the increase resulting from commercial forest land being transferred to productive-reserved. Nonforest land area increased from 5.8 million acres in 1959 to 5.9 million acres in 1972.

Unit 5–Northern Prairie

The conversion of 364,200 acres of commercial forest land to nonforest uses in the Northern Prairie accounted for one-fifth of the total change from commercial forest to nonforest in Missouri between surveys (table 6). Commercial forest land was diverted to pasture, cropland, rights-of-way, urban development, and recreational areas. Commercial forest land converted to urban uses in the Northern Prairie made up 42 percent of the State total; commercial forest land transferred to recreational uses accounted for 46 percent of the State total (table 19, Appendix).

The growing-stock inventory on the converted forest land totaled 176.6 million cubic feet in 1959. This volume loss due to land use change was the largest of any unit. If the trees had been left to grow, by 1972 the volume would have increased to an estimated 185.3 million cubic feet.

The small addition to the commercial forest land base through natural reversion of nonforest land did not balance the shifts from commercial forest land to nonforest uses, resulting in a net decrease in the commercial forest land area from 1959 to 1972 of 347,200 acres.

The acreage of noncommercial forest land remained unchanged (23,100 acres) in Unit 5 from 1959 to 1972. The nonforest land area increased in the Northern Prairie from 11.3 million acres in 1959 to 11.7 million acres in 1972.

The River Units

Unit 6–Riverborder Unit

The area of commercial forest land in the Riverborder Unit increased 8,600 acres between 1959 and 1972 (table 7). The entire increase was the result of the natural reversion of nonforest land to commercial forest (table 20, Appendix). This was the only Unit to show an increase in commercial forest area and consequent decrease in nonforest area. The area of noncommercial forest land increased from 47,400 acres in 1959 to 47,600 in 1972.

The Riverborder Unit is of importance to Missouri forestry concerns because in 1969 the Region supplied 40 percent of the total cooperage volume harvested in the State[3]. The Riverborder Unit also boasts a large portion of Missouri's forest types that are commercially important or are vital to the State's wildlife as habitat. Over 67 percent of the State's total eastern redcedar acreage occurs in the Unit as does 63 percent of the cottonwood acreage, 40 percent of the maple-beech acreage and 26 percent of the white oak acreage.

Table 7.—*Area by land class, Riverborder Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	1,975.9	1,984.5	+0.4
noncommercial forest			
productive-reserved	15.2	15.2	0
unproductive	32.2	32.4	+0.6
subtotal	2,023.3	2,032.1	+0.4
Nonforest land	3,827.6	3,816.5	−0.3
Total land	5,850.9	5,848.6	(1)

(1) Less than 0.1 percent.

Table 8.—*Area by land class, Mississippi Riverbottom Unit, Missouri, 1959 and 1972*
(In thousand acres)

Land class	1959	1972	Percent change
Forest land			
commercial forest	212.5	124.4	−41.4
noncommercial forest			
productive-reserved	0.9	0.9	0
unproductive	—	—	—
subtotal	213.4	125.3	−41.3
Nonforest land	1,947.2	2,034.4	+4.5
Total land	2,160.6	2,159.7	(1)

(1) Less than 0.1 percent.

Unit 7–Mississippi Riverbottom Unit

The Mississippi Riverbottom Unit has the smallest acreage of commercial forest land in Missouri—124,400 acres in 1972—only 1 percent of the State's total. Forest type composition of the Unit includes cottonwood (38 percent of the State's total) oak-gum-cypress (14 percent), elm-ash-cottonwood (7 percent) and small amounts of maple-beech and oak types.

Of the 212,500 acres of commercial forest land in the Unit in 1959, 93,100 acres were reclassified as nonforest in 1972 (table 8). In 1959 there were 61.5 million cubic feet of growing-stock inventory on this land, by 1972 this volume could have grown to an estimated 64.6 million cubic feet. Commercial forest land in the Mississippi Riverbottom was converted primarily to cropland and pasture. Most of the new cropland was placed in soybean production (table 21, Appendix).

New acreage was added to the commercial forest base through natural reversion of nonforest land; however, shifts from commerical forest land to nonforest resulted in a net loss of 88,100 acres of commercial forest from 1959 to 1972.

The area of noncommercial forest land remained essentially unchanged from 1959 to 1972. Nonforest land increased from 1.9 million acres in 1959 to 2.0 million acres in 1972.

WHAT IS THE SITE QUALITY OF AREAS REMOVED FROM THE COMMERCIAL FOREST LAND BASE?

Knowledge of which sites are being removed from the commercial forest base is necessary for responsible land-use planning and forest management. For example, if commercial forest land being transferred to other uses is of poor quality, it may be socially and/or economically desirable to encourage this shift in land use. However, if sites with high productive potential are being removed from timber production, the transfer of commercial forest land to other uses may have a detrimental effect on future timber supplies and the State's forest products industries. In this case, policy makers may wish to take steps to discourage the diversion of high-site quality forest land.

The average volume per acre on commercial forest land converted to nonforest uses was 327.6 cubic feet in 1959. This volume is lower than the average volume per acre on all commercial forest land in that year (414 cubic feet). In order to analyze the site quality of commercial forest land converted to other uses, it was necessary to use site quality classes defined in the 1959 Forest Survey. At that time, forest site quality classes of excellent, good, medium and poor were defined by the number of logs produced by the dominant tree species on a site (table 9). These site quality classes

Table 9.—*Site quality classes used in Missouri's second Forest Survey, 1959*

Site class	Number of 16-foot logs			Generalized site conditions
	Hardwoods	Pine	Cedar	
Poor	1-1½	1-1½	1	Usually found on south and west slopes, upper parts of ridges, and on dry flats.
Medium	2-2½	3-3½	1	Usually found on north and west slopes, moist flats, and bottoms.
Good	3-3½	4-4½	2	Usually found in coves and bottomlands.
Excellent	4+	5+	2½+	

estimate the potential of a site for timber production and do not directly assess the potential of a site for producing other forest resources such as wildlife, recreation and water. The current method of evaluating site quality categorizes sites according to the productive potential of the site, expressed in cubic feet of growth per acre per year.

Of the 1.9 million acres of commercial forest land transferred to other uses between surveys, approximately 1.1 million acres were classified as medium sites (table 10). Commercial forest land was converted to other uses on 408,700 acres of good forest sites, 324,700 acres of poor forest sites, and 85,400 acres of excellent forest sites. Although the acreage of excellent commercial forest land does not seem large, 85,400 acres is almost one-quarter of the total excellent site acreage reported in 1959.

In general, the commercial forest land lost to other uses in the Ozark Units was of poorer site quality than that lost in the Prairie and River Units. Of the 85,400 acres of excellent commercial forest land lost between surveys, 63,400 acres (74 percent) occurred in the Northern Prairie Unit 13,400 acres (16 percent) in the Riverbottom Unit and 8,600 acres (10 percent) in the Eastern Ozarks.

The 324,700 acres of poor quality commercial forest land lost to other uses between surveys were concentrated in the Ozark Units (302,400 acres) with small amounts of poor quality acreage also being lost in the Prairie Units.

Table 10.—*Area of commercial forest land converted to other uses between 1959 and 1972 by Survey Unit and site class, Missouri*

(In thousand acres)

Survey unit	All site classes	1959 site class			
		Excellent	Good	Medium	Poor
Eastern Ozarks	286.1	8.6	26.6	142.8	108.1
Southwestern Ozarks	557.1	—	94.2	371.0	91.9
Northwestern Ozarks	325.1	—	11.4	211.3	102.4
Southern Prairie	158.1	—	45.1	101.6	11.4
Northern Prairie	364.2	63.4	171.2	118.7	10.9
Riverborder	128.9	—	9.9	119.0	—
Mississippi Riverbottom	93.1	13.4	50.3	29.4	—
All units	1,912.6	85.4	408.7	1,093.8	324.

WHICH FOREST TYPES HAVE BEEN MOST AFFECTED BY LAND-USE CHANGE?

Most forest types decreased in area between 1959 and 1972. The black-scarlet oak type underwent the largest decrease (fig. 3). This type covered 5.2 million acres in 1959; by 1972 the type area was 4.4 million acres, a decline of 15 percent. The elm-ash-cottonwood type lost the second largest area (623,000 acres), as the type acreage was cut almost in half. The largest percentage area lost was in the shortleaf pine type. Over 58 percent of the 1959 shortleaf pine area was converted to other types and uses by 1972. Other forest types showing a decline in area between surveys included eastern redcedar, shortleaf pine-oak, and oak-gum-cypress.

A decline in the areas of Missouri forest types may portend a decline in the volumes of commercial species available for harvest. Several tree species common to the forest types mentioned above are important commercial species. Black oak, a tree common to the black-scarlet oak type, is a major species used in the production of charcoal; 46 percent of the wood removed from Missouri's forests for charcoal production in 1969 was black oak[3]. Black walnut, an important veneer species, is a common associate of the black-scarlet oak type. Hickory, an associate of both the shortleaf pine type and eastern redcedar type, supplied over one-fifth of Missouri's veneer log volume in 1969 and was the major source of material for handle bolts.

If the volume of wood produced per acre remains unchanged while the number of acres available for production declines, the total volume of wood produced will decline. If it is desirable to maintain

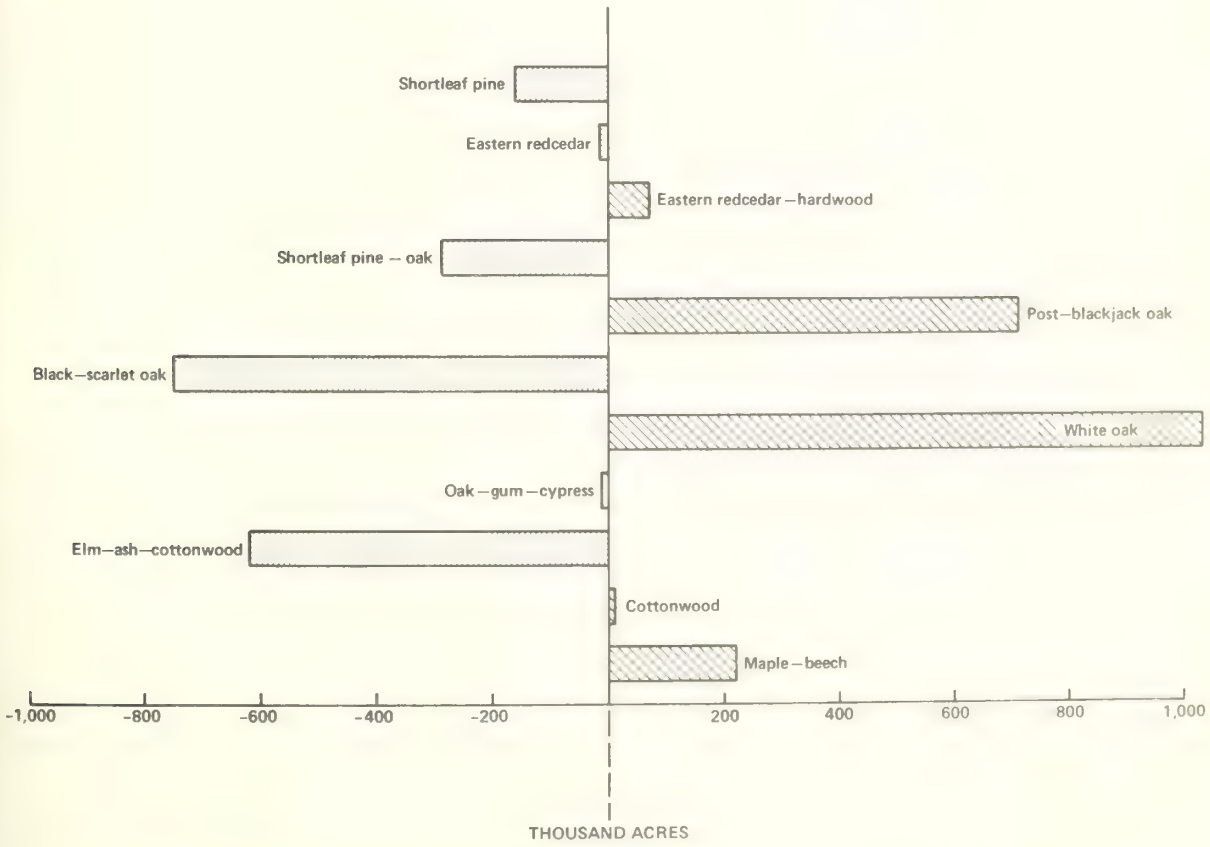


Figure 3.—*Net increases or decreases in commercial forest area by forest type, Missouri, 1959-1972.*

current levels of production, management must be intensified on the remaining acreage.

Several of Missouri's forest types increased in area between surveys. The area of white oak type increased 1.0 million acres between 1959 and 1972; post-blackjack oak increased 713,000 acres; maple-beech, 226,000 acres; eastern redcedar-hardwood, 74,000 acres, and cottonwood, 3,000 acres.

As with declining forest type areas, increases in the areas of certain forest types can give some indication of what changes may occur in the inventory volumes of commercial species. Increases in the area of a forest type may produce future increases in the volume of certain species of wood that may be made available to forest products industries. For example, the white oak species group, the principal group in the white oak type, composed over 35 percent of the total timber products output from roundwood volume removed from commercial forest land in 1969[3]. Increases in the area of the white oak type could increase the volumes of wood available for white oak products in the distant future. In 1969, cottonwood logs made up 45 percent of the pulpwood output in Missouri; increases in cottonwood acreage could mean a future increase in pulp material.

WHAT HAPPENED TO THE LANDS THAT REMAINED COMMERCIAL FOREST LAND BETWEEN 1959 AND 1972?

Although most (74 percent) of Missouri's commercial forests underwent little or no treatment between surveys, 2.7 million acres benefited from forest management practices (table 11).

Harvesting was the most common treatment in Missouri—it was the one treatment occurring in every region. Harvesting, as the term is used here, includes clearcutting, clearcutting with artificial regeneration, and harvesting practices where only part of a merchantable stand is removed. Over one-third of the total acreage harvested outside national forests was in the black-scarlet oak forest type. The post-blackjack oak and white oak forest types accounted for an additional 40 percent of the harvest acreage.

Timber stand improvement was carried out on 127,700 acres of commercial forest between 1959 and 1972. Timber stand improvement practices include: (1) operations where trees at least 5 inches in diameter are eliminated to provide better growing conditions for crop trees, (2) operations in

Table 11.—*Treatments occurring on commercial forest land between 1959 and 1972*
(In thousand acres)

Survey Unit	1959 Commercial forest	Treatments occurring between 1959 and 1972					Acreage changing land class	
		No change	Harvest	Timber stand improvements	Stand conversion	Planted or seeded	Non-commercial forest	Non-forest
Eastern Ozarks	4,259.4	2,911.7	971.1	40.9	35.7	13.9	70.8	215.
Southwestern Ozarks	2,815.4	1,579.2	646.1	26.2	6.8	—	5.0	552.
Northwestern Ozarks	2,146.3	1,588.1	233.1	—	—	—	58.9	266.
Southern Prairie	742.3	444.9	101.2	38.1	—	—	31.1	127.
Northern Prairie	1,666.5	1,007.9	271.9	22.5	—	—	—	364.
Riverborder	1,975.9	1,592.1	254.9	—	—	—	—	128.
Mississippi Riverbottom	212.5	83.1	34.9	—	—	1.4	—	93.
Total 1959	13,818.3	9,207.0	2,513.2	127.7	42.5	15.3	165.8	1,746.

young stands to free small trees from weeds, vines, or sod-growing grasses, (3) operations where less desirable species of trees with poor form are removed to liberate potential crop trees, and (4) pruning. Timber stand improvement was undertaken in the Eastern Ozarks, Southern Prairie, Southwestern Ozarks and Northern Prairie.

Stand conversion is the transformation of a stand of trees from one forest type to another through practices such as cutting, planting, or clearing. Over 42,500 acres of commercial forest land underwent stand conversion between 1959 and 1972. The Eastern Ozarks and the Southwestern Ozarks were the only Units affected by stand conversion. Over half of the acreage in other than national forest ownership undergoing stand conversion went to the black-scarlet oak type (16,100 acres). It is most likely that this acreage was previously classified as post-blackjack oak, which after cutting or clearing operations converted to the faster growing oak species in the black-scarlet oak type. An additional 15 percent (4,700 acres) of the stand conversion acreage went into white oak. The 2,100 acres of commercial forest converted to shortleaf-pine oak, were probably hardwood stands poisoned to encourage pine growth.

The planting or seeding of commercial tree species occurred on 15,300 acres of commercial forest land. The vast majority of this acreage was in the Eastern Ozarks, with a small amount occurring in the Mississippi Riverbottoms. Shortleaf pine was the predominant species planted.

SUMMARY

1. There is a shift in land use occurring in Missouri. The area of commercial forest land declined by 1.5 million acres (11 percent) between 1959 and 1972, while the areas of noncommercial forest land and nonforest land increased 106,300 acres and 1.2 million acres respectively.

2. The Southwestern Ozarks lost more commercial forest land than any other Survey Unit. The Mississippi Riverbottom Unit lost the largest percentage of its commercial forest area (41 percent). The Riverborder Unit was the only region to gain commercial forest land between surveys.

3. Over half of the commercial forest land converted to other uses was classified as medium quality forest land in 1959. Almost one-quarter of the excellent forest acreage reported in 1959 was converted to other uses by 1972.

4. The white oak forest type showed the greatest net increase in area. Nonstocked commercial forest land, black-scarlet oak and elm-ash-cottonwood forest types underwent the greatest decreases in area.

5. Of the land remaining commercial forest between surveys, most (74 percent) underwent little or no treatment between surveys. Harvesting was the most common treatment occurring in Missouri, followed by timber stand improvement, stand conversion and regeneration.

APPENDIX

ACCURACY OF SURVEY

Forest survey information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. A measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that the results for the sample differ, by no more than the amount indicated, from the results that would have been obtained if all trees in the State had been measured (a 100-percent inventory), using the same tree measurements.

For example, the estimated area of commercial forest land in the State in 1972, 12,364.7 thousand acres, has a sampling error of ±0.78 percent (±96.4 thousand acres). The chances are two out of three, then, that the commercial forest area falls between 12,268.3 and 12,461.1 thousand acres (12,364.7±96.4).

Item	State totals	Sampling error[4]
		(Percent)
Growing stock:		
Volume	6,001.5 MM cubic feet	1.54
Growth	177.3 MM cubic feet	2.19
Removals	167.7 MM cubic feet	4.18
Sawtimber:		
Volume	15,054.9 MM board feet	2.17
Growth	363.5 MM board feet	3.01
Removals	542.0 MM board feet	7.58
Commercial forest land	12,364.7 M acres	0.78

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases. The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is much higher than that for total commercial area in the State. An approximation of the increasing sampling error can be obtained from table 12, which shows the sampling errors associated with estimates smaller than totals in Missouri.

[4]*At the 68-percent probability level.*

Table 12.—*Sampling errors*[1] *for estimates smaller than State totals of volume, net growth and removals, and of area of commercial forest land in Missouri, 1972*

Sampling error	Commercial forest	Growing stock			Sawtimber		
		Volume	Growth	Removals	Volume	Growth	Removals
Percent	*Thousand*	*Million cubic feet*			*[2]Million board feet*		
1	7,467.1	14,212.3	853.6	2,930.1	71,068.3	3,297.5	31,142.3
2	1,866.8	3,553.2	213.4	732.5	17,767.1	824.4	7,785.6
3	829.7	1,579.2	94.8	325.6	7,896.5	366.4	3,460.3
4	466.7	888.3	53.3	183.1	4,441.8	206.1	1,946.4
5	298.7	568.5	34.1	117.2	2,842.7	131.9	1,245.7
10	74.7	142.1	8.5	29.3	710.7	33.0	311.4
15	33.2	63.2	3.8	13.0	315.9	14.7	138.4
20	18.7	35.5	2.1	7.3	177.7	8.2	77.9
25	11.9	22.7	1.4	4.7	113.7	5.3	49.8
50	3.0	5.7	0.3	1.2	28.4	1.3	12.5
100	0.7	1.4	0.1	0.3	7.1	0.3	3.1

[1]At the 68-percent probability level.
[2]International ¼-inch rule.

SURVEY PROCEDURE

Data used in this report were gathered from permanent sample plots (each of which contained one variable-radius plot with basal area factor five) established during the 1959 survey. These 1,640 points were remeasured by superimposing a 10-point variable-radius plots (basal area factor 37.5) over the existing plot in addition to remeasuring the basal area factor five plot.

DEFINITION OF TERMS

Land-Use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1960.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than ⅛-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1960.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet in width.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Tree Classes

All live trees.—Growing-stock, rough and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods at least 11.0 inches.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or number of trees in a stand compared to the basal area and/or number of trees required to utilize fully the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the percent number of trees is sufficient to produce 80 square feet of basal area per acre when the trees do reach 5 inches d.b.h.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Missouri are:

Shortleaf pine.–Forests in which shortleaf pine comprises a plurality of the stocking. (Common associates include oak, hickory and gum.)

Eastern redcedar.—Forests in which eastern redcedar comprises a plurality of the stocking. (Common associates include oak and hickory.)

Eastern redcedar-hardwood.—Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking but in which eastern redcedar comprises 25 to 50 percent of the stocking. (Common associates include gum, hickory, and yellow-poplar.)

Shortleaf pine-oak.—Forests in which upland oaks comprise a plurality of the stocking, but in which shortleaf pine comprises 25 to 50 percent of the stocking.

Post-blackjack oak.—Forests in which post oak or blackjack oak, singly or in combination, comprises a plurality of the stocking except where shortleaf pine or redcedar comprises 25 to 50 percent.

Black-scarlet oak.—Forests in which upland oaks or hickory, singly or in combination, comprises a plurality of the stocking except where shortleaf pine or redcedar comprises 25 to 50 percent, or where white oak or post and blackjack oak comprise a plurality. (Common associates include yellow-poplar, elm, maple, and black walnut.)

White oak.—Forests in which white oak and other white oak species, singly or in combination, comprise a plurality of the stocking except where shortleaf pine or redcedar comprises 25 to 50 percent.

Oak-gum-cypress.—Bottomland forests in which bottomland oaks such as pin, swamp white, and shingle oaks, along with tupelo, blackgum, sweetgum, and cypress, singly or in combination, comprise a plurality of the stocking. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Elm-ash-cottonwood.—Forests in which elm, ash, or cottonwood, singly or in combination, comprises a plurality of the stocking. (Common associates include willow, sycamore, beech, and maple.)

Cottonwood.—Forests in which cottonwood comprises a plurality of the stocking.

Maple-beech.—Forests in which hard maple or beech, singly or in combination, comprises a plurality of the stocking. (Common associates include elm and basswood.)

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet.

Timber Removals

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, and other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products, or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

'able 13.— *Changes in the commercial forest land base between 1959 and 1972, by Survey Unit, Missouri*
(In thousand acres)

	State Total	Eastern Ozarks	Southwestern Ozarks	Northwestern Ozarks	Southern Prairie	Northern Prairie	River-border	Mississippi Riverbottoms
59 Commercial forest area	13,818.3	4,259.4	2,815.4	2,146.3	742.3	1,666.5	1,975.9	212.5
ADDITIONS TO THE COMMERCIAL FOREST LAND BASE, BY LAND CLASS								
ıncommerical forest								
Productive - reserved	—	—	—	—	—	—	—	—
Unproductive	67.8	16.3	10.3	41.2	—	—	—	—
ınforest	391.2	94.4	42.8	57.6	36.9	17.0	137.5	5.0
Subtotal	459.0	110.7	53.1	98.8	36.9	17.0	137.5	5.0
REDUCTIONS IN THE COMMERCIAL FOREST LAND BASE, BY LAND CLASS								
ıncommercial forest								
Productive - reserved	165.8	70.8	5.0	58.9	31.1	—	—	—
Unproductive	—	--	—	—	—	—	—	—
ınforest								
Pasture (other)	1,165.9	111.6	438.9	193.7	101.7	222.5	89.8	7.7
Cropland	230.0	41.4	10.6	—	25.3	61.9	9.7	81.1
Pastureland (herbicides)	166.2	6.6	74.4	66.7	—	18.5	—	—
Rights-of-way	84.8	24.0	20.5	—	—	30.5	9.8	—
Urban	36.4	15.9	5.1	—	—	15.4	—	—
Recreation	33.1	7.9	—	—	—	15.4	9.8	—
Other	30.4	7.9	2.6	5.8	—	—	9.8	4.3
Subtotal	1,912.6	286.1	557.1	325.1	158.1	364.2	128.9	93.1
972 Commercial forest area	12,364.7	4,084.0	2,311.4	1,920.0	621.1	1,319.3	1,984.5	124.4

Table 14.— *Changes in land use, Missouri, all units, 1959-1972*
(In thousand acres)

		1972 Land class				
		Forest				
959 Land class		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
orest						
Commercial	13,818.3	11,905.7	165.8	—	1,746.8	—
Productive-reserved	90.3	—	90.3	—	—	—
Unproductive	357.8	67.8	—	269.3	20.7	—
lonforest	30,038.2	391.2	—	29.0	29,502.7	115.3
otal land	44,304.6					
972 Total land	44,189.3	12,364.7	256.1	298.3	31,270.2	

[1]Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 15.— *Changes in land use, Missouri, Eastern Ozarks, 1959-1972*
(In thousand acres)

1959 Land class		1972 Land class				
		Forest				
		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
Forest						
Commercial	4,259.4	3,973.3	70.8	—	215.3	—
Productive-reserved	26.5	—	26.5	—	—	—
Unproductive	71.9	16.3	—	55.6	—	—
Nonforest	1,792.0	94.4	—	7.7	1,703.0	−13.1
Total land	6,149.8					
1972 Total land	6,162.9	4,084.0	97.3	63.3	1,918.3	

[1]Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 16.— *Changes in land use, Missouri, Southwestern Ozarks, 1959-1972*
(In thousand acres)

1959 Land class		1972 Land class				
		Forest				
		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
Forest						
Commercial	2,815.4	2,258.3	5.0	—	552.1	—
Productive-reserved	17.6	—	17.6	—	—	—
Unproductive	121.2	10.3	—	103.7	7.2	—
Nonforest	2,573.5	42.8	—	5.6	2,437.7	87.4
Total land	5,527.7					
1972 Total land	5,440.3	2,311.4	22.6	109.3	2,997.0	

[1]Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 17.— *Changes in land use, Missouri, Northwestern Ozarks, 1959-1972*
(In thousand acres)

		1972 Land class				
		Forest				
59 Land class		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
rest						
Commercial	2,146.3	1,821.2	58.9	—	266.2	—
Productive-reserved	14.7	—	14.7	—	—	—
Unproductive	116.6	41.2	—	61.9	13.5	—
nforest	2,780.9	57.6	—	15.5	2,678.8	29.0
tal land	5,058.5					
72 Total land	5,029.5	1,920.0	73.6	77.4	2,958.5	

[1] Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 18.— *Changes in land use, Missouri, Southern Prairie, 1959-1972*
(In thousand acres)

		1972 Land class				
		Forest				
59 Land class		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
rest						
Commercial	742.3	584.2	31.1	—	127.0	—
Productive-reserved	3.7	—	3.7	—	—	—
Unproductive	4.5	—	—	4.5	—	—
nforest	5,786.5	36.9	—	—	5,745.4	4.2
tal land	6,537.0					
72 Total land	6,532.8	621.1	34.8	4.5	5,872.4	

[1] Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 19.— *Changes in land use, Missouri, Northern Prairie, 1959-1972*
(In thousand acres)

1959 Land class		1972 Land class				
		Forest				
		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
Forest						
Commercial	1,666.5	1,302.3	—	—	364.2	—
Productive-reserved	11.7	—	11.7	—	—	—
Unproductive	11.4	—	—	11.4	—	—
Nonforest	11,330.5	17.0	—	—	11,308.9	4.6
Total land	13,020.1					
1972 Total land	13,015.5	1,319.3	11.7	11.4	11,673.1	

[1]Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 20.— *Changes in land use, Missouri, Riverborder, 1959-1972*
(In thousand acres)

1959 Land class		1972 Land class				
		Forest				
		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
Forest						
Commercial	1,975.9	1,847.0	—	—	128.9	—
Productive-reserved	15.2	—	15.2	—	—	—
Unproductive	32.2	—	—	32.2	—	—
Nonforest	3,827.6	137.5	—	0.2	3,687.6	2.3
Total land	5,850.9					
1972 Total land	5,848.6	1,984.5	15.2	32.4	3,816.5	

[1]Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

Table 21.— *Changes in land use, Missouri, Mississippi Riverbottoms, 1959-1972*
(In thousand acres)

		1972 Land class				
		Forest				
959 Land class		Commercial	Productive-reserved	Unproductive	Nonforest	Area Adjustment[1]
orest						
Commercial	212.5	119.4	—	—	93.1	—
Productive-reserved	0.9	—	0.9	—	—	—
Unproductive	0.0	—	—	—	—	—
lonforest	1,947.2	5.0	—	—	1,941.3	0.9
otal land	2,160.6				—	
972 Total land	2,159.7	124.4	0.9	0.0	2,034.4	

[1]Area adjustment indicates changes in Bureau of Census land area estimates between surveys. It may include land converted to water.

☆ U.S. Government Printing Office: 1979—667 820, 80 Region No. 6

Jakes, Pamela J., John S. Spencer, Jr., and Burton L. Essex.
1978. Land-use change in Missouri, 1959-1972. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-40, 19 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Missouri's third Forest Survey showed an 11 percent decline in commercial forest area between 1959 and 1972. Most of this land was converted to nonforest uses, primarily pasture. Of the land that remained classified as commercial forest, 75 percent underwent little or no treatment between surveys.

OXFORD: 913/914(778). KEY WORDS: area, land conversion, forest treatments, forest survey.

Jakes, Pamela J., John S. Spencer, Jr., and Burton L. Essex.
1978. Land-use change in Missouri, 1959-1972. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-40, 19 p. North Cent. For. Exp. Stn., St. Paul, Minnesota.

Missouri's third Forest Survey showed an 11 percent decline in commercial forest area between 1959 and 1972. Most of this land was converted to nonforest uses, primarily pasture. Of the land that remained classified as commercial forest, 75 percent underwent little or no treatment between surveys.

OXFORD: 913/914(778). KEY WORDS: area, land conversion, forest treatments, forest survey.

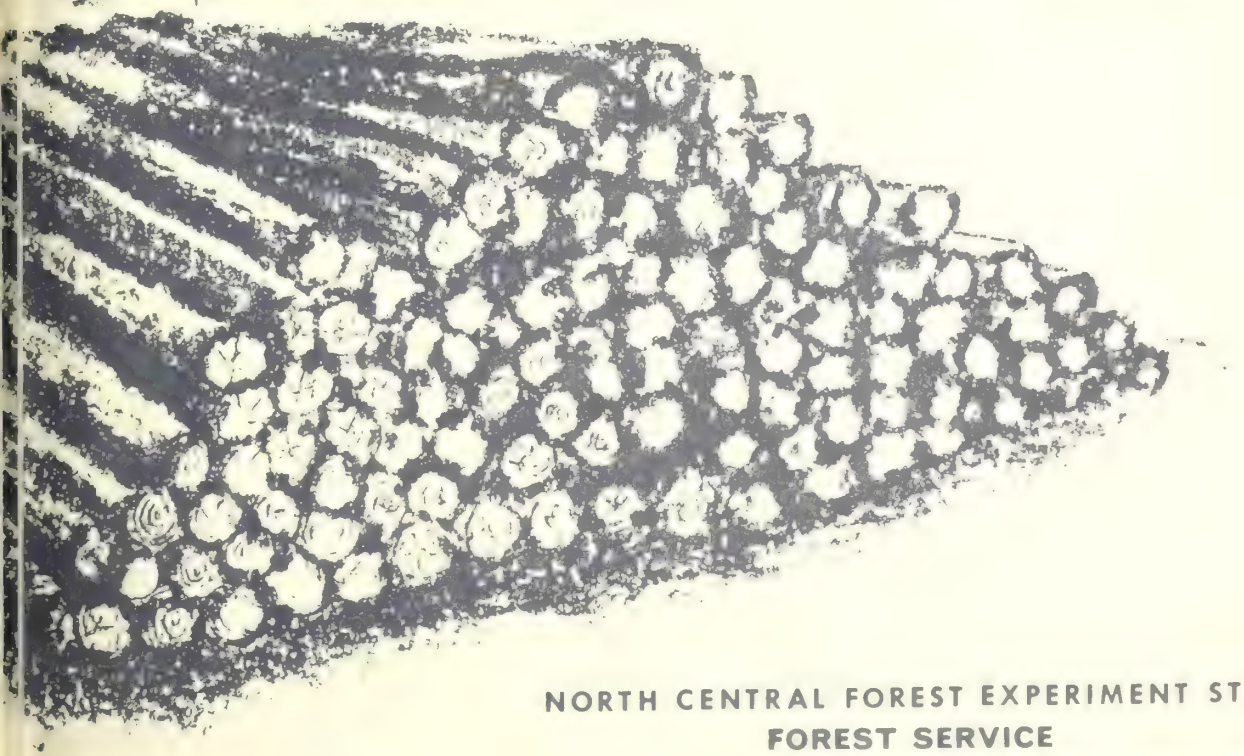
Birds, animals and flowers are dying to tell us...no pollution, please!

USDA FOREST SERVICE
RESOURCE BULLETIN **NC-41**

CLEMSON UNIVERSITY LIBRARY
JUL 23 1979
SCI., TECH. & AGR. DIV.

PULPWOOD PRODUCTION
in the
NORTH CENTRAL REGION
BY COUNTY
1977

JAMES E. BLYTH
W. BRAD SMITH



NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

We gratefully acknowledge the cooperation of pulpmills using North Central States timber in 1977. Thanks are also due the Michigan Department of Natural Resources for collecting data from Michigan pulpmills.

HIGHLIGHTS

Lake States

Lake States pulpwood production inched ahead 1 percent in 1977 to 4.74 million cords. Increased pulpwood demand paralleled the national increase in paper and paperboard output.

Significant production gains were in aspen, soft maple, and balsam fir; noteworthy declines were in elm and paper birch. Elm production may have peaked in 1976.

Whole tree chip production for pulpwood was 145,000 cords, primarily from aspen. Minnesota is the dominant producer; none came from Wisconsin.

Pine production in Wisconsin surpassed the previous high of 1974; the spruce harvest in Minnesota was the lowest in 32 years.

Softwood residue imports from Canada, destined primarily for Wisconsin, increased for the fifth straight year.

Lake States pulping capacity may rise 1,000 tons per day by the early 1980's.

Central States

Although demand for Central States pulpwood fell 4 percent, loggers cut a record volume of softwoods. Pine plantations in Illinois were the principal source. Output of soft hardwood continued to decline. Two-thirds of the hardwood production was from residue. More than half of the pulpwood produced was shipped outside the Central States.

Pulpwood receipts fell 9 percent; 15 percent came from other regions.

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication February 20, 1979
1979

PULPWOOD PRODUCTION IN THE NORTH CENTRAL REGION BY COUNTY, 1977

James E. Blyth, *Principal Market Analyst,*
and **W. Brad Smith,** *Associate Mensurationist*

This is the 19th annual report of the pulpwood harvest in Lake States counties and the 18th annual report of the Central States harvest. Pulpwood constitutes more than half the timber products harvested annually in the Lake States (Michigan, Minnesota, and Wisconsin) and is an important product in the Central States (Illinois, Indiana, Iowa, and Missouri).

Current detailed pulpwood production[1] information is necessary for intelligent planning and decisionmaking in wood procurement, forest resource management, and forest industry development. Also, researchers need current pulpwood information for planning projects.

Pulpmills using North Central States timber in 1977 reported their pulpwood receipts by species groups and counties of origin. This report presents the results of the survey, analyzes the data where appropriate, compares results with 1976 or earlier years, and discusses trends in pulpwood production and use.

The Lake States and Central States are discussed separately because the timber types in each area are different and less information can be released about the Central States (more detailed data on pulpwood production and receipts in the Central States would reveal the operations of individual mills).

[1]*Pulpwood production, determined from mill receipts, is the annual volume of pulpwood cut in a specific county or region, plus the annual wood residue volume produced by sawmills, veneer mills, etc., in a specific State or region that was used for pulp manufacturing. Pulpwood receipts are the volume of wood received by mills in a specific State or region, regardless of the geographic source.*

Pulpwood production in Minnesota is completely and accurately shown. However, to prevent disclosure of confidential information about softwood pulpwood use by individual companies, the total quantity of softwood pulpwood imports into Minnesota from Canada and exports from Minnesota to Canada are not reported. Thus, some Minnesota softwood shipped to Canada is shown as remaining and used in Minnesota, and receipts of Canadian softwood in Minnesota are understated.

LAKE STATES

Production

Lake States pulpwood production inched up 1 percent in 1977 to 4.74 million cords (table 1). Pulpwood demand was stimulated by a parallel advance of 1 percent in national paper and paperboard output in 1977.

Eighty-nine of every 100 cords produced were roundwood (including chips from roundwood); the remainder was residue from local wood-using plants.[2] Most (86 percent) of the production gain in 1977 came from residue. Of the total production, only 70,000 cords were shipped out of the Lake States.

Although the roundwood harvest rose nominally, several species recorded significant gains including aspen (68,000 cords), soft maple (33,000 cords) and balsam fir (29,000 cords). Major declines were in elm (55,000 cords) and white birch

[2]*Residue is the byproduct from sawmills, veneer mills, cooperage mills, and other wood-using plants that is used for pulping. Residue includes slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from slabs, edgings, and veneer cores.*

Table 1.—*Production and imports of pulpwood, Lake States, 1977*
(In standard cords, unpeeled)

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S. 2/	CANADA	TOTAL IMPORTS	
CEDAR								
MICHIGAN	6663	0	1270	7933	0	0	0	7933
TOTAL	6663	0	1270	7933	0	0	0	7933
BALSAM FIR								
MICHIGAN	44463	0	7336	51799	0	0	0	51799
MINNESOTA	0	94249	0	94249	0	0	0	94249
WISCONSIN	41659	1114	65995	108759	0	0	0	108759
EXPORTED 3/	8362	3803	0	12165	0	0	0	0
TOTAL	94484	99166	73331	266972	0	0	0	254807
HEMLOCK								
MICHIGAN	51889	0	10212	62101	0	0	0	62101
WISCONSIN	10187	0	33259	43446	0	0	0	43446
TOTAL	62076	0	43471	105547	0	0	0	105547
JACK PINE								
MICHIGAN	124790	0	10535	135325	0	0	0	135325
MINNESOTA	0	132005	0	132005	0	1957	1957	133962
WISCONSIN	58660	[illegible]	179259	263668	4/ 37614	0	37614	301282
EXPORTED 3/	0	3911	0	3911	0	0	0	0
TOTAL	183450	161665	189794	534909	37614	1957	39571	570569
RED PINE								
MICHIGAN	56762	0	4560	61322	0	0	0	61322
MINNESOTA	0	5436	0	5436	0	0	0	5436
WISCONSIN	8952	2917	88742	100611	0	0	0	100611
TOTAL	65714	8353	93302	167369	0	0	0	167369
WHITE PINE								
MICHIGAN	9482	0	2130	11612	0	0	0	11612
MINNESOTA	0	3356	0	3356	0	0	0	3356
WISCONSIN	3216	22	11285	14523	0	0	0	14523
TOTAL	12698	3378	13415	29491	0	0	0	29491
SPRUCE								
MICHIGAN	22272	0	2538	24810	0	0	0	24810
MINNESOTA	0	125424	0	125424	0	0	0	125424
WISCONSIN	18848	26124	16065	61037	0	32946	32946	93983
EXPORTED 3/	6743	1512	0	8255	0	0	0	0
TOTAL	47863	153060	18603	219526	0	32946	32946	244217
TAMARACK								
MICHIGAN	1415	0	484	1899	0	0	0	1899
MINNESOTA	0	15773	0	15773	0	0	0	15773
WISCONSIN	1455	26145	3495	31095	0	21	21	31116
TOTAL	2870	41918	3979	48767	0	21	21	48788
ASH								
MICHIGAN	9303	0	49	9352	0	0	0	9352
WISCONSIN	5360	46	20327	25733	0	0	0	25733
EXPORTED 3/	0	0	116	116	0	0	0	0
TOTAL	14663	46	20492	35201	0	0	0	35085
ASPEN								
MICHIGAN	368607	0	1207	369814	0	0	0	369814
MINNESOTA	0	612421	10650	623071	0	476	476	623547
WISCONSIN	163398	67827	683702	914927	0	0	0	914927
EXPORTED 3/	0	16600	665	17265	0	0	0	0
TOTAL	532005	696848	696224	1925077	0	476	476	1908288
BALSAM POPLAR								
MICHIGAN	19474	0	0	19474	0	0	0	19474
MINNESOTA	0	14652	0	14652	0	0	0	14652
WISCONSIN	0	0	55	55	0	0	0	55
TOTAL	19474	14652	55	34181	0	0	0	34181

(TABLE 1 CONTINUED ON NEXT PAGE)

(TABLE 1 CONTINUED)

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S. 2/	CANADA	TOTAL IMPORTS	
BASSWOOD								
MICHIGAN	3677	0	33	3710	0	0	0	3710
MINNESOTA	0	2000	0	2000	0	0	0	2000
WISCONSIN	48	0	7873	7921	0	0	0	7921
EXPORTED 3/	0	0	273	273	0	0	0	0
TOTAL	3725	2000	8179	13904	0	0	0	13631
BEECH								
MICHIGAN	9439	0	0	9439	0	0	0	9439
WISCONSIN	407	0	9	416	0	0	0	416
TOTAL	9846	0	9	9855	0	0	0	9855
WHITE BIRCH								
MICHIGAN	40747	0	721	41468	0	0	0	41468
MINNESOTA	0	27325	0	27325	0	0	0	27325
WISCONSIN	4443	2715	90401	97559	0	0	0	97559
EXPORTED 3/	0	0	223	223	0	0	0	0
TOTAL	45190	30040	91345	166575	0	0	0	166352
YELLOW BIRCH								
MICHIGAN	6551	0	177	6728	0	0	0	6728
WISCONSIN	10439	3	11591	22033	0	0	0	22033
TOTAL	16990	3	11768	28761	0	0	0	28761
COTTONWOOD								
EXPORTED 3/	0	0	44	44	0	0	0	0
TOTAL	0	0	44	44	0	0	0	0
ELM								
MICHIGAN	5572	0	168	5740	0	0	0	5740
MINNESOTA	0	2263	0	2263	0	0	0	2263
WISCONSIN	18713	59	150095	168867	0	0	0	168867
EXPORTED 3/	0	0	512	512	0	0	0	0
TOTAL	24285	2322	150775	177382	0	0	0	176870
HICKORY								
WISCONSIN	0	0	776	776	0	0	0	776
EXPORTED 3/	0	0	253	253	0	0	0	0
TOTAL	0	0	1029	1029	0	0	0	776
HARD MAPLE								
MICHIGAN	32254	0	903	33157	0	0	0	33157
WISCONSIN	27713	526	57156	85395	0	0	0	85395
EXPORTED 3/	0	0	219	219	0	0	0	0
TOTAL	59967	526	58278	118771	0	0	0	118552
SOFT MAPLE								
MICHIGAN	77303	0	552	77855	0	0	0	77855
MINNESOTA	0	325	0	325	0	0	0	325
WISCONSIN	11748	89	81892	93929	0	0	0	93929
EXPORTED 3/	0	0	302	302	0	0	0	0
TOTAL	89051	414	82746	172461	0	0	0	172309
RED OAK								
MICHIGAN	94900	0	175	95075	0	0	0	95075
MINNESOTA	0	4705	0	4705	0	0	0	4705
WISCONSIN	50	0	43369	43419	0	0	0	43419
EXPORTED 3/	0	0	1657	1657	0	0	0	0
TOTAL	94950	4705	45201	144856	0	0	0	143199
WHITE OAK								
MICHIGAN	12395	0	0	12395	0	0	0	12395
MINNESOTA	0	190	0	190	0	0	0	190
WISCONSIN	0	0	8872	8872	0	0	0	8872
EXPORTED 3/	0	0	623	623	0	0	0	0
TOTAL	12395	190	9495	22080	0	0	0	21457
OTHER HARDWOODS								
MICHIGAN	2287	0	19	2306	0	0	0	2306
WISCONSIN	2801	0	6244	9045	0	0	0	9045
EXPORTED 3/	0	0	105	105	0	0	0	0
TOTAL	5088	0	6368	11456	0	0	0	11351

(TABLE 1 CONTINUED ON NEXT PAGE)

(TABLE 1 CONTINUED)

SPECIES AND DESTINATION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S. 2/	CANADA	TOTAL IMPORTS	
TOTAL ROUNDWOOD								
MICHIGAN	1000245	0	43069	1043314	0	0	0	1043314
MINNESOTA	0	1040174	10650	1050824	0	2433	2433	1053257
WISCONSIN	388088	153536	1560462	2102086	37614	32967	70581	2172667
EXPORTED 3/	15105	25894	4992	45923	0	0	0	0
TOTAL	1403438	1219536	1619173	4242147	37614	35400	73014	4269238
RESIDUE, SOFTWOOD								
MICHIGAN	16136	0	962	17098	0	0	0	17098
MINNESOTA	0	31947	0	31947	15245	7815	23060	55007
WISCONSIN	517	0	47080	47597	189497	62232	251729	299326
EXPORTED 3/	4110	3387	0	7497	0	0	0	0
TOTAL	20763	35334	48042	104139	204742	70047	274789	371431
RESIDUE, HARDWOODS								
MICHIGAN	142849	0	20437	163286	9406	0	9406	172692
MINNESOTA	0	77052	15633	92785	4007	4769	8776	101561
WISCONSIN	17967	544	105974	124485	0	0	0	124485
EXPORTED 3/	9969	253	6538	16760	0	0	0	0
TOTAL	170785	77949	148582	397316	13413	4769	18182	398738
ALL WOOD MATERIAL								
MICHIGAN	1159230	0	64468	1223698	9406	0	9406	1233104
MINNESOTA	0	1149273	26283	1175556	19252	15017	34269	1209825
WISCONSIN	406572	154080	1713516	2274168	227111	95199	322310	2596478
EXPORTED 3/	29184	29466	11530	70180	0	0	0	0
TOTAL	1574986	1332819	1815797	4743602	255769	110216	365985	5039407

1/ VERTICAL COLUMNS OF FIGURES UNDER BOX HEADING "PRODUCTION BY STATES" PRESENT THE AMOUNT OF PULPWOOD CUT IN EACH STATE.
2/ MOSTLY WESTERN STATES.
3/ PULPWOOD SHIPPED TO MILLS OUTSIDE OF REGION.
4/ PONDEROSA PINE.

(29,000 cords). Dutch elm disease has destroyed much of the elm resource in Michigan's Lower Peninsula and in southern and central Wisconsin. Consequently, use of elm pulpwood may have peaked in 1976 in the Lake States.

Whole tree chip[3] production for pulpwood was 145,000 cords (3 percent of the total) in 1977. Production by species group and State was:

State	Softwoods	Aspen	Other hardwoods
	(In thousand cords)		
Michigan	2.6	28.4	15.9
Minnesota	—	96.4	1.4

None was produced in Wisconsin, although some experimental use of whole tree chips was tried at Wisconsin mills in the last 5 years. During the next decade, Wisconsin mills will probably use some whole tree chips again, particularly if competition for wood continues to increase.

[3]*Pulpwood produced from chipping entire trees (all portions of trees above ground, except the stumps).*

Whole tree chips are becoming important fo fuelwood at some Lake States pulp mills, a us likely to accelerate. Yields from whole tree chip are generally 30 to 100 percent greater than fro conventional logging operations. Mills may fin whole tree chips attractive for fuel and pulp wood—the barky chips for fuel and the "clean chips for pulpwood.

The rate of increase in whole tree chip use fo pulpwood depends on changes in logging and pul manufacturing technology, technology for sepa rating bark from fiber, demand for forest products the paper and paperboard product mix, and con sumer tastes for end products.

Michigan.—Michigan furnished 1.59 millio cords of pulpwood, up 54,000 cords from 1976 an surpassed only by the production of 1974. Harves gains were concentrated in aspen, red oak, balsam fir, and spruce. All Michigan areas except th northern Lower Peninsula had larger harvests the northern Lower Peninsula supplies mor roundwood than any other Unit and is the mos

stable area of production. Counties contributing more than 90,000 cords each of roundwood were Iron, Delta, Marquette, and Menominee.

Minnesota.—Production rose slightly (24,000 cords) to 1.33 million cords. Demand strengthened for aspen and balsam fir, but spruce output fell to the lowest level in 32 years. Pulpwood harvesting declined for the third consecutive year in the Northern Aspen-Birch Unit, but rose in each of the other Units. St. Louis, Koochiching, and Itasca Counties supplied 59 percent of the roundwood for pulpwood.

Wisconsin.—Producers lowered their output 24,000 cords to 1.82 million cords. Demand for pine surpassed the previous high in 1974. For the fifth consecutive year, demand for softwood residue from Wisconsin reached a new high. Production losses were primarily in central Wisconsin. Marinette, Oneida, and Florence Counties were the leading producers.

The distribution of the harvest is shown in two ways: first, the amount of pulpwood cut relative to the merchantable volume in major pulpwood species (fig. 1); and second, the amount of pulpwood cut relative to commercial forest area (fig. 2). Cutting pressure was heaviest (per 1,000 cords of merchantable volume in principal pulpwood species) in central and northeastern Wisconsin and Michigan's Upper Peninsula.

Figure 1.—*Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species by Forest Survey Unit, 1977. (Heavy lines delineate the boundaries of the Forest Survey Units in each State.)*

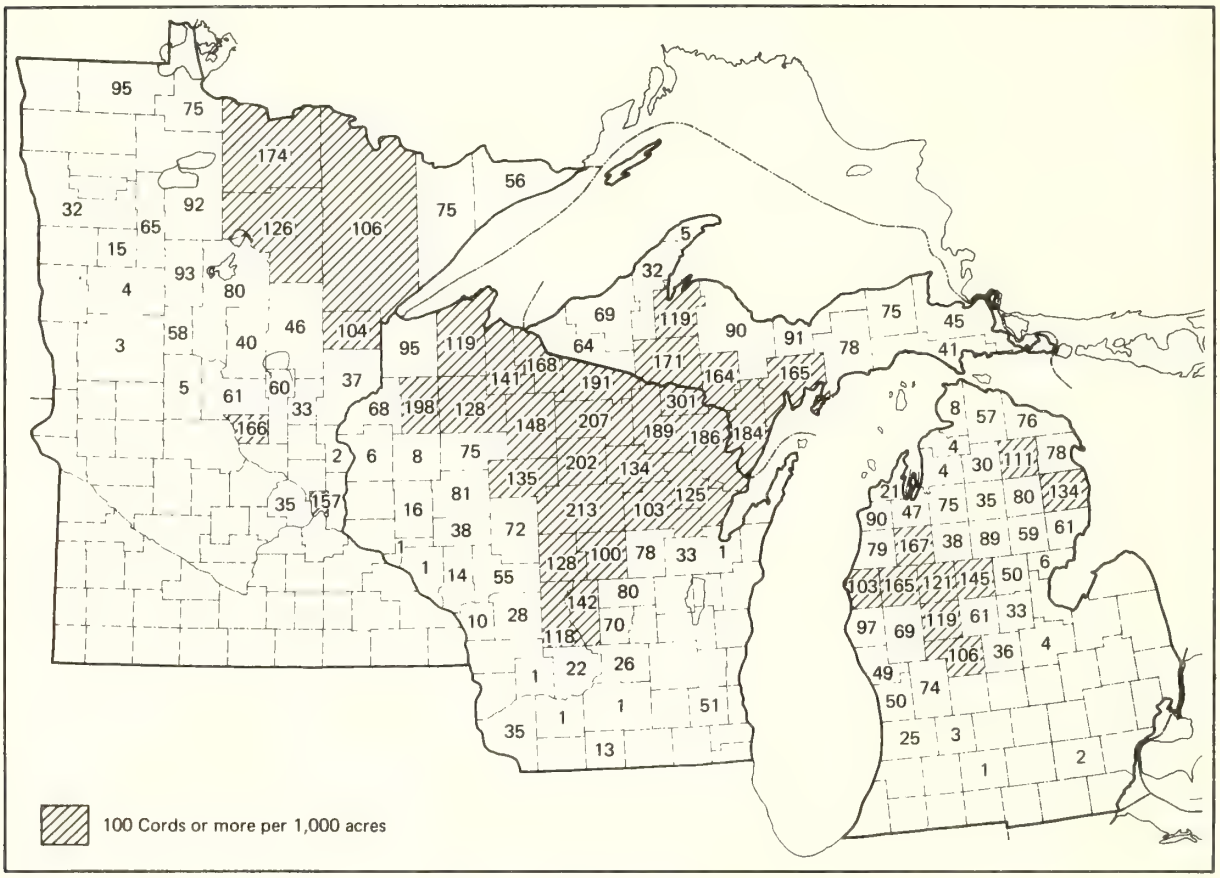


Figure 2.—*Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1977. Acres of stocked commercial forest land were determined during the last forest survey in each State.*

Receipts

Pulpwood producers shipped 5.04 million cords of pulpwood to 41 Lake States pulpmills in 1977. Of these mills, 36 used aspen, including all mills in Michigan and Minnesota (table 2). Softwood residue receipts climbed to a record level of 371,000 cords. Other major gains were in aspen and soft maple. Receipts of elm and white birch dropped more than 25,000 cords.

For the fifth consecutive year, Canada increased shipments of softwood residue to the Lake States; Wisconsin continued to be the primary market.

Imports from other States rose 8 percent to 256,000 cords. South Dakota, Wyoming, Colorado and Montana supplied four-fifths of these imports as softwood residue chips.

Michigan.—Wood procurement spurted ahead 119,000 cords. Hemlock demand was the highest since 1951. Michigan sources provided 95 percent of the pulpwood.

Wisconsin.—Pulpwood receipts fell 116,000 cords with most species contributing to the decline. Hemlock and spruce demand hit new lows spruce for the fourth year in a row. In contrast deliveries of softwood residue were 20,000 cords higher than in any other year.

Table 2.—*Industrial plants using the different species of wood for pulping in 1977*
(In numbers)

Species and kind of material	Lake States	Michigan	Minnesota	Wisconsin
Aspen	36	8	9	19
Balsam fir	17	3	5	9
Birch	19	5	3	11
Hemlock	8	2	—	6
Pine	9	3	2	4
Spruce	18	2	5	11
Tamarack	7	1	2	4
Maple	15	6	—	9
Oak	12	5	1	6
Other hardwoods	17	6	2	9
Wood chips (residue)	20	6	6	8
Slabwood and other residue	5	—	2	3
Total Plants[1]	41	8	9	24

[1]Some plants use more than one species, so numbers in columns cannot be added.

Industry Trends and Analysis

Average daily production was 10,800 tons per day, a gain of 200 tons from 1976 (table 3). Ownership changed at one mill; no mills closed or began operations. If announced mill expansions and new mill construction are realized, pulping capacity will increase about 1,000 tons per day by the early 1980's. Increased competition for wood will also likely come from additional particleboard and waferboard capacity and from mills burning roundwood chips for fuel.

The average annual volume of Lake States softwood residue used as pulpwood in 1975-1977 was double the average volume used in 1970-1972. This trend will probably continue, perhaps at a lower rate.

During the last decade, demand for hemlock declined at Wisconsin mills and increased at Michigan mills. These compensating shifts resulted in relatively stable harvests of hemlock.

CENTRAL STATES

Production

Demand for Central States pulpwood fell 4 percent to 445,000 cords in 1977 (table 4). However, Central States loggers cut a record volume of softwoods. Pine plantations in Illinois are maturing and providing pulpwood from commercial thinnings. For the fifth straight year, soft hardwood production dropped and was about half the annual volume cut between 1967 and 1973. Hard hardwood harvesting declined to 64,000 cords. Demand remained firm for pulpwood from wood residue generated at Central States wood-using mills; hardwood residue comprised two-thirds of total production.

Exports from the Central States rose 10,000 cords, the fourth straight annual increase. More than half (53 percent) of total pulpwood production was shipped outside the Central States to Kentucky, Ohio, Michigan, and Minnesota. About three-fourths (76 percent) of the exports was hardwood residue. To remain competitive with mills in other areas, Illinois, Indiana, and Missouri sawmills depend on these pulpwood export markets for their residue.

Indiana continued as the leading pulpwood producer followed in order by Missouri, Illinois, and Iowa (the only State to increase production). Only 13 percent of Missouri's production was roundwood.

Loggers cut pulpwood in 82 counties: 29 in Illinois, 27 in Indiana, 17 in Missouri, and 9 in Iowa (fig. 3). Harvest areas expanded in west central

Table 3.—*Active wood pulp mills in the Lake States by location, type of pulp produced, and average daily production, 1977*

COMPANY	LOCATION	AVERAGE PRODUCTION IN TONS PER 24 HOURS 1/				
		TOTAL	SULFITE	SULFATE	GROUNDWOOD AND OTHER MECHANICAL	SEMI-CHEMICAL
MICHIGAN:						
ABITIBI CORP.	ALPENA	430	0	0	430	0
CELOTEX CORP.	L ANSE	270	0	0	270	0
HOERNER WALDORF CORP.	ONTONAGON	440	0	0	0	440
MANISTIQUE PULP AND PAPER CO.	MANISTIQUE	90	0	0	90	0
MEAD CORP.	ESCANABA	750	0	600	150	0
MENASHA CORP.	OTSEGO	225	0	0	0	225
PACKAGING CORP.OF AMERICA	FILER CITY	600	0	0	0	600
WARREN CO., S.D.	MUSKEGON	250	0	250	0	0
TOTAL.....	8 PLANTS.....	3055	0	850	940	1265
MINNESOTA :						
BLANDIN PAPER CO.	GRAND RAPIDS	350	0	0	350	0
HENNEPIN PAPER CO.	LITTLE FALLS	75	0	0	75	0
BOISE CASCADE CORP.	INTERNATIONAL FALLS	880	0	340	540	0
POTLATCH CORP.	CLOQUET	440	0	440	0	0
SUPERWOOD CORP.	REMIDJI	90	0	0	90	0
ST REGIS PAPER CO.	SARTELL	125	0	0	125	0
SUPERWOOD CORP.	DULUTH	350	0	0	350	0
HOERNER WALDORF CORP.	ST PAUL	300	0	0	0	300
CONWED CORP.	CLOQUET	350	0	0	350	0
TOTAL.....	9 PLANTS.....	2960	0	780	1880	300
WISCONSIN :						
AMERICAN CAN CO.	GREEN BAY	210	150	0	60	0
WEYERHAEUSER CO.	ROTHSCHILD	200	200	0	0	0
BADGER PAPER MILLS	PESHTIGO	110	110	0	0	0
NCR,APPLETON PAPER DIV.	COMBINED LOCKS	200	0	0	200	0
CONSOLIDATED PAPERS , INC.	APPLETON	130	130	0	0	0
CONSOLIDATED PAPERS , INC.	STEVENS POINT	100	0	0	100	0
CONSOLIDATED PAPERS , INC.	WISCONSIN RAPIDS	720	0	475	245	0
GREEN BAY PACKAGING, INC.	GREEN BAY	200	0	0	0	200
FLAMBEAU PAPER CO.	PARK FALLS	115	115	0	0	0
MIDTEC PAPER CORP.	KIMBERLY	115	0	0	115	0
PENTAIR INDUSTRIES	NIAGARA	170	0	0	170	0
MOSINEE PAPER MILLS CO.	MOSINEE	175	0	175	0	0
NEKOOSA PAPERS INC.	NEKOOSA	310	0	310	0	0
NEKOOSA PAPERS INC.	PORT EDWARDS	215	215	0	0	0
OWENS-ILLINOIS	TOMAHAWK	620	0	0	0	620
PROCTER AND GAMBLE INC.	GREEN BAY	2/	2/	2/	2/	2/
SCOTT PAPER CO.	OCONTO FALLS	115	115	0	0	0
ST REGIS PAPER CO.	RHINELANDER	75	75	0	0	0
FLINKOTE COMPANY	CORNELL	100	0	0	100	0
SUPERIOR FIBRE PRODUCTS CO.	SUPERIOR	180	0	0	180	0
THILMANY PULP AND PAPER CO	KAUKAUNA	400	0	400	0	0
TOMAHAWK PULP CO., INC.	TOMAHAWK	50	0	0	50	0
WAUSAU PAPER MILLS CO.	BROKAW	185	185	0	0	0
BOISE CASCADE CORP.	PHILLIPS	100	0	0	100	0
TOTAL.....	24 PLANTS.....	4795	1295	1360	1320	820
ALL STATES	41 PLANTS	10810	1295	2990	4140	2385

1/ LOCKWOOD'S DIRECTORY OF THE PAPER AND ALLIED INDUSTRIES-1978
2/ CAPACITY NOT AVAILABLE.

Table 4. *Production and imports of pulpwood, Central States, 1977*

(In standard cords, unpeeled)[1]

SPECIES AND DESTINATION	PRODUCTION BY STATES 2/					IMPORTS			TOTAL RECEIPTS
	ILLINOIS	INDIANA	IOWA	MISSOURI	REGIONAL TOTAL	LAKE STATES	OTHER U.S.	TOTAL IMPORTS	
SOFTWOODS									
ILLINOIS	8947	3476	0	200	12623	0	0	0	12623
EXPORTED 4/	5613	0	0	30	5643	0	0	0	0
TOTAL	14560	3476	0	230	18266	0	0	0	12623
SOFT HARDWOODS									
ILLINOIS	4126	2529	0	4454	11109	0	0	0	11109
IND.,IOWA,MO. 3/	4063	9958	16255	2313	33089	2124	0	2124	35213
EXPORTED 4/	4441	0	0	1937	6378	0	0	0	0
TOTAL	12630	12487	16255	8704	50576	2124	0	2124	46322
HARD HARDWOODS									
ILLINOIS	120	0	0	0	120	0	0	0	120
IND.,IOWA,MO. 3/	4872	9909	8436	939	24156	2868	0	2868	27024
EXPORTED 4/	8063	25155	0	6324	39542	0	0	0	0
TOTAL	13055	35064	8436	7263	63818	2868	0	2868	27144
TOTAL ROUNDWOOD									
ILLINOIS	13193	6005	0	4654	23852	0	0	0	23852
IND.,IOWA,MO. 3/	8935	19867	25191	3252	57245	4992	0	4992	62237
EXPORTED 4/	18117	25155	0	8291	51563	0	0	0	0
TOTAL	40245	51027	25191	16197	132660	4992	0	4992	86089
RESIDUE,SOFTWOOD									
ILLINOIS	1755	0	2006	4464	8225	6505	4197	10702	18927
IND.,IOWA,MO. 3/	0	0	0	0	0	0	4800	4800	4800
EXPORTED 4/	1893	0	0	3159	5052	0	0	0	0
TOTAL	3648	0	2006	7623	13277	6505	8997	15502	23727
RESIDUE,HARDWOODS									
ILLINOIS	24998	5014	0	1914	31926	11195	0	11195	43121
IND.,IOWA,MO. 3/	4491	34610	19062	29262	87430	5565	0	5565	92995
EXPORTED 4/	37766	69873	4007	68058	179704	0	0	0	0
TOTAL	67255	109497	23074	99234	299060	16760	0	16760	136116
ALL WOOD MATERIAL									
ILLINOIS	39946	11019	2006	11032	64003	17700	4197	21897	85900
IND.,IOWA,MO. 3/	13426	54477	44258	32514	144675	10557	4800	15357	160032
EXPORTED 4/	57776	95028	4007	79508	236319	0	0	0	0
TOTAL	111148	160524	50271	123054	444997	28257	8997	37254	245932

1/ FACTORS USED IN CONVERTING TO STANDARD GREEN CORDS (128 CU. FT.) WERE:
4,500 POUNDS OF SOFT HARDWOOD ROUNDWOOD;
5,000 POUNDS OF HARD HARDWOOD OR CONIFEROUS ROUNDWOOD;
4,100 POUNDS OF SOFTWOOD CHIPS (GREEN);
4,400 POUNDS OF HARDWOOD CHIPS (GREEN);
2,500 POUNDS OF CHIPS (ALL SPECIES,DRY).

2/ VERTICAL COLUMNS OF FIGURES UNDER BOX HEADING "PRODUCTION BY STATES" PRESENT THE AMOUNT OF PULPWOOD CUT IN EACH STATE.

3/ COMBINED TO PREVENT DISCLOSURE OF INDIVIDUAL MILL RECEIPTS.

4/ PULPWOOD SHIPPED TO MILLS OUTSIDE THE REGION.

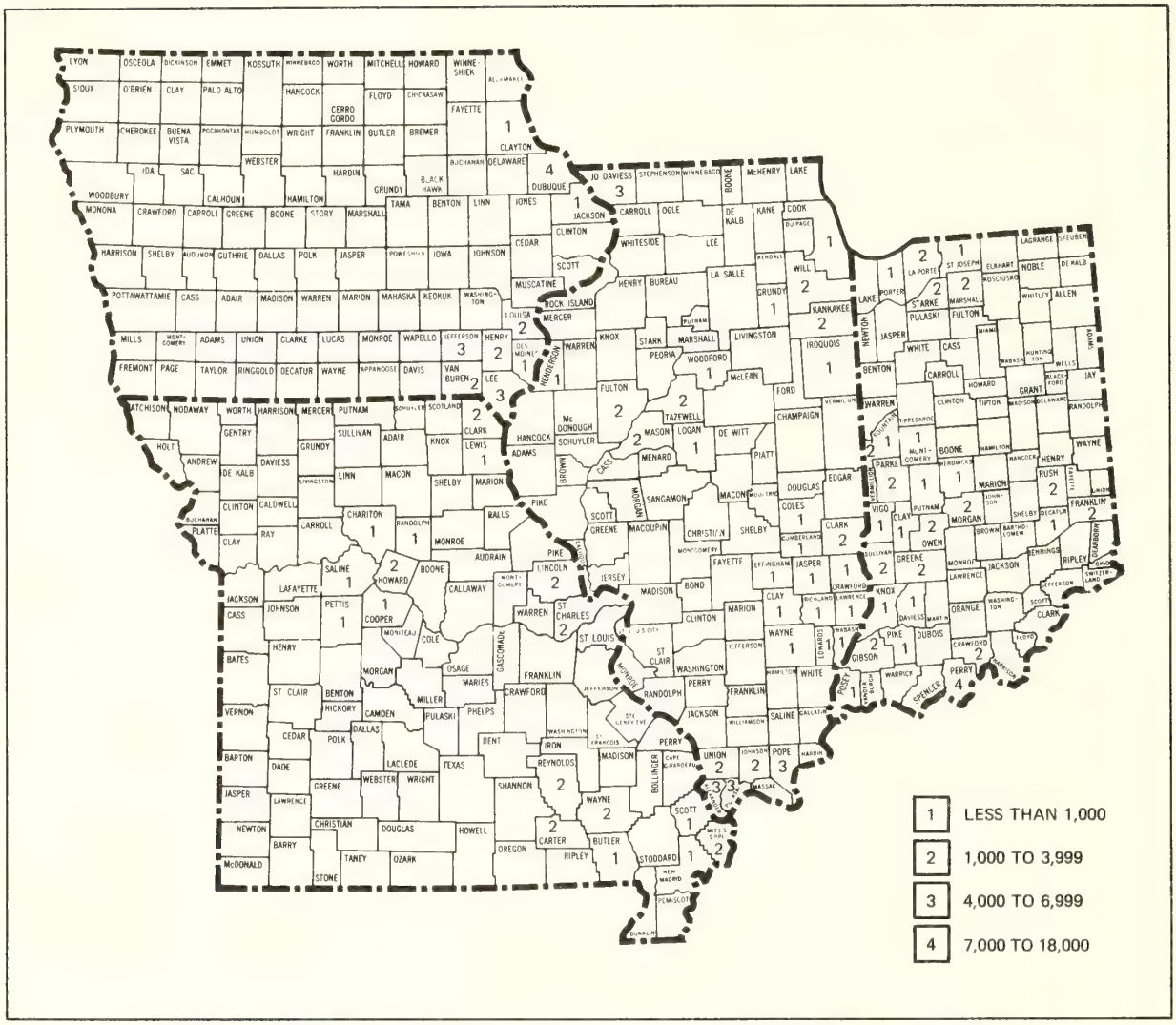


Figure 3.—*Harvest of pulpwood bolts in the Central States by counties, in standard cords, 1977.*

Illinois, northwestern Indiana, and southeastern Iowa; and contracted in southeastern Illinois, south central Indiana, central Iowa, and northeastern Missouri.

Receipts

Pulpwood receipts dipped to 246,000 cords at 12 Central States pulpmills, off 9 percent from 1976. These mills procured 15 percent of their wood from other regions. All roundwood and hardwood residue imports came from the Lake States. Softwood residues were imported from 12 States scattered throughout the United States.

Industry Trends and Analysis

Average daily pulp production remained at 1,100 tons (table 5). No significant changes in pulping capacity were announced, and mill ownership did not change.

In 1965 wood residue from Central States mills was first used for making pulp. Six years later,

mill residue became the major source of pulpwood in the Central States:

Year	Pulpwood Production from: Roundwood	Mill residue	All sources
	(In thousand cords)		
1965	204	27	231
1967	186	66	252
1969	187	189	376
1971	205	216	421
1973	199	255	454
1975	123	284	407
1977	133	312	445

Roundwood has declined as a pulpwood source because most Central States loggers are oriented toward saw log and veneer log production, woods labor is sometimes in short supply when demand for pulpwood is high, and logging costs have escalated.

Demand for pulpwood from mill residue has grown because sawmills and veneer mills usually have large quantities of residue available when pulpwood demand is heavy; new and rehabilitated sawmills often install equipment for manufacturing high-quality pulpwood chips; average production per sawmill has been increasing, allowing greater opportunities for producing chips profitably; and labor problems are less severe at mills than in the woods during peak demands for pulpwood.

One potential problem has surfaced recently for pulpmills—competition for mill residue from fuelwood markets. If the value of residue for fuel increases faster than the value for pulpwood, pulpmills may have to increase their procurement area if they still prefer residue to roundwood.

Table 5.—*Active woodpulp mills in the Central States by location, type of pulp produced, and average daily production, 1977*

COMPANY	LOCATION	AVERAGE PRODUCTION IN TONS PER 24 HOURS 1/ TOTAL	SULFITE	SULFATE	GROUNDWOOD AND OTHER MECHANICAL	SEMI-CHEMICAL
ILLINOIS:						
BIRD AND SON, INC.	CHICAGO	40	0	0	40	0
CELOTEX CORP.	PEORIA	90	0	0	90	0
CERTAIN-TEED PRODUCTS CORP.	EAST ST LOUIS	100	0	0	100	0
FLINTKOTE CO, THE	MT CARMEL	40	0	0	40	0
GAF CORP.	JOLIET	100	0	0	100	0
JOHNS-MANVILLE PRODUCTS CORP.	WAUKEGAN	50	0	0	50	0
CELOTEX CORP.	WILMINGTON	30	0	0	30	0
TOTAL.....	7 PLANTS.....	450	0	0	450	0
INDIANA :						
WESTON PAPER AND MFG. CO.	TERRE HAUTE	270	0	0	0	270
TOTAL.....	1 PLANT.....	270	0	0	0	270
IOWA :						
CELOTEX CORP.	DUBUQUE	90	0	0	90	0
CONSOLIDATED PACKAGING CORP.	FORT MADISON	140	0	0	0	140
TOTAL.....	2 PLANTS.....	230	0	0	90	140
MISSOURI :						
GAF CORP.	KANSAS CITY	90	0	0	90	0
HUEBERT FIBREBOARD, INC.	BOONEVILLE	60	0	0	60	0
TOTAL.....	2 PLANTS.....	150	0	0	150	0
ALL STATES	12 PLANTS	1100	0	0	690	410

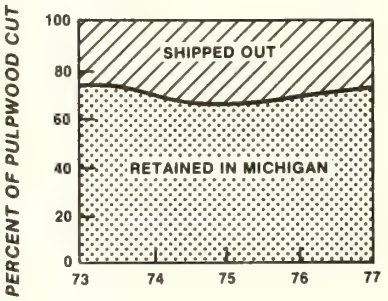
1/ LOCKWOOD'S DIRECTORY OF THE PAPER AND ALLIED INDUSTRIES-1978

APPENDIX

Table 6.—*Lake States pulpwood production by State of origin and destination, 1973-1977*
(In thousand standard cords, roughwood basis)

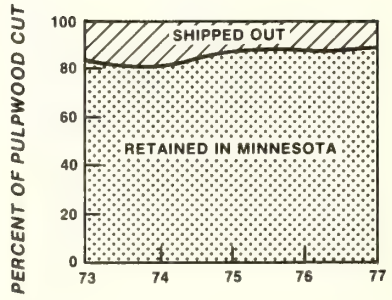
MICHIGAN

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1973	1,585	—	418	1,131	36
1974	1,843	—	534	1,290	19
1975	1,280	—	449	814	17
1976	1,541	—	434	1,081	26
1977	1,595	—	407	1,159	29
5-year average	1,569	—	449	1,095	25



MINNESOTA

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1973	1,376	1,152	194	(*)	30
1974	1,578	1,297	262	(*)	19
1975	1,359	1,173	178	—	8
1976	1,309	1,109	182	—	18
1977	1,333	1,149	154	—	30
5-year average	1,391	1,176	194	—	21



WISCONSIN

	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1973	1,758	14	1,671	55	18
1974	2,053	14	2,004	25	10
1975	1,505	20	1,460	19	6
1976	1,840	23	1,784	24	9
1977	1,816	26	1,714	64	12
5-year average	1,794	19	1,727	37	11

*Less than 500 cords

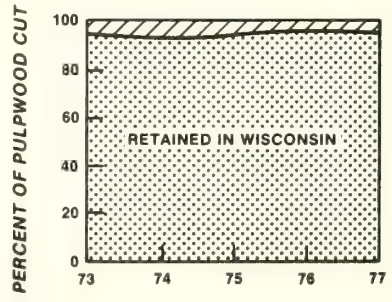


Table 7.—*Lake States pulpwood production from roundwood by Forest Survey Unit and destination by State, 1977*
(In hundred standard cords, roughwood basis)

MICHIGAN

UNIT	TOTAL CUT	DESTINATION OF PULPWOOD			
		MICHIGAN	MINNESOTA	WISCONSIN	OTHER
E. UPPER PENINSULA	3896	2516	0	1237	143
W. UPPER PENINSULA	4582	2071	0	2511	0
N. LOWER PENINSULA	5162	5021	0	133	8
S. LOWER PENINSULA	394	394	0	0	0
TOTAL ROUNDWOOD	14034	10002	0	3881	151
TOTAL RESIDUES	1916	1590	0	185	141
TOTAL	15950	11592	0	4066	292

MINNESOTA

UNIT	TOTAL CUT	DESTINATION OF PULPWOOD			
		MICHIGAN	MINNESOTA	WISCONSIN	OTHER
NORTHERN ASPEN-BIRCH	6934	0	5878	798	258
NORTHERN PINE	4798	0	4102	696	0
CENTRAL HARDWOOD	440	0	422	18	0
PRAIRIE	24	0	0	24	0
TOTAL ROUNDWOOD	12196	0	10402	1536	258
TOTAL RESIDUES	1132	0	1091	5	36
TOTAL	13328	0	11493	1541	294

WISCONSIN

UNIT	TOTAL CUT	DESTINATION OF PULPWOOD			
		MICHIGAN	MINNESOTA	WISCONSIN	OTHER
NORTHEASTERN	7159	303	0	6856	0
NORTHWESTERN	6078	104	107	5867	0
CENTRAL	2753	24	0	2729	0
SOUTHWESTERN	131	0	0	81	50
SOUTHEASTERN	71	0	0	71	0
TOTAL ROUNDWOOD	16192	431	107	15604	50
TOTAL RESIDUES	1966	214	156	1531	65
TOTAL	18158	645	263	17135	115

Table 8.—*Lake States pulpwood production from roundwood by species, State, and Forest Survey Unit, 1973-1977*

(In thousand standard cords, roughwood basis)

MICHIGAN

Unit	Aspen					Balsam fir				
	Annual Production					Annual Production				
	1973	1974	1975	1976	1977	1973	1974	1975	1976	1977
E. ½ Upper Peninsula	93	119	68	93	106	41	40	36	41	48
W. ½ Upper Peninsula	225	294	138	176	195	26	32	34	31	45
N. ½ Lower Peninsula	275	282	228	216	222	2	2	4	3	2
S. ½ Lower Peninsula	10	11	1	6	9	—	—	—	—	—
Total	603	706	435	491	532	69	74	74	75	95
MINNESOTA										
Northern aspen-birch	407	460	357	372	375	37	52	76	44	60
Northern pine	228	282	236	276	292	28	41	45	30	39
Central hardwood	38	62	22	25	30	(1)	—	—	(1)	—
Prairie	—	—	—	—	—	—	—	—	—	—
Total	673	804	615	673	697	65	93	121	74	99
WISCONSIN										
Northeastern	380	383	286	345	334	34	49	64	61	57
Northwestern	331	342	276	308	329	32	35	33	26	15
Central	46	71	25	38	31	1	1	1	2	1
Southwestern	3	1	—	—	1	—	—	—	—	—
Southeastern	1	(1)	1	2	1	—	—	—	—	—
Total	761	797	588	693	696	67	85	98	89	73
Lake States	2,037	2,307	1,638	1,857	1,925	201	252	293	238	267

MICHIGAN

Unit	Birch					Hemlock				
	Annual Production					Annual Production				
	1973	1974	1975	1976	1977	1973	1974	1975	1976	1977
E. ½ Upper Peninsula	19	24	6	20	22	22	13	16	35	31
W. ½ Upper Peninsula	16	35	8	29	29	36	39	34	44	31
N. ½ Lower Peninsula	25	25	22	20	11	—	(1)	—	(1)	(1)
S. ½ Lower Peninsula	—	(1)	(1)	(1)	(1)	—	—	—	—	—
Total	60	84	36	69	62	58	52	50	79	62
MINNESOTA										
Northern aspen-birch	18	15	16	21	15	—	—	—	—	—
Northern pine	23	24	18	23	13	—	—	—	—	—
Central hardwood	1	5	2	2	2	—	—	—	—	—
Prairie	—	(1)	(1)	—	—	—	—	—	—	—
Total	42	44	36	46	30	—	—	—	—	—
WISCONSIN										
Northeastern	30	38	33	50	54	21	32	30	27	32
Northwestern	40	59	44	56	44	10	9	13	9	8
Central	1	5	6	8	5	1	3	3	7	3
Southwestern	1	(1)	(1)	—	(1)	—	—	—	—	—
Southeastern	—	(1)	(1)	(1)	(1)	(1)	1	(1)	—	—
Total	72	102	83	114	103	32	45	46	43	43
Lake States	174	230	155	229	195	90	97	96	122	105

(Table 8 continued on next page)

(Table 8 continued)

MICHIGAN

Unit	Pine					Spruce				
	Annual Production					Annual Production				
	1973	1974	1975	1976	1977	1973	1974	1975	1976	1977
E. ½ Upper Peninsula	67	87	59	88	82	28	19	18	17	27
W. ½ Upper Peninsula	36	36	25	43	49	18	20	25	14	21
N. ½ Lower Peninsula	88	127	143	140	119	(1)	1	2	1	(1)
S. ½ Lower Peninsula	12	9	8	10	12	—	—	—	—	—
Total	203	259	235	281	262	46	40	45	32	48

MINNESOTA

Northern aspen-birch	125	139	116	104	97	159	154	153	129	110
Northern pine	77	98	79	64	73	54	51	49	46	43
Central hardwood	3	2	4	4	4	(1)	(1)	—	(1)	(1)
Prairie	(1)	(1)	—	—	—	2	2	—	—	—
Total	205	239	199	172	174	215	207	202	175	153

WISCONSIN

Northeastern	43	62	46	55	68	10	13	18	14	16
Northwestern	100	100	64	96	103	6	6	7	4	3
Central	85	125	122	124	113	—	(1)	(1)	1	*
Southwestern	3	2	2	5	8	—	—	—	—	—
Southeastern	1	2	5	6	4	—	(1)	—	—	—
Total	232	291	239	286	296	16	19	25	19	19
Lake States	640	789	673	739	732	277	266	272	226	220

MICHIGAN

Unit	Tamarack					Miscellaneous hardwoods				
	Annual Production					Annual Production				
	1973	1974	1975	1976	1977	1973	1974	1975	1976	1977
E. ½ Upper Peninsula	2	1	1	(1)	2	93	124	35	82	69
W. ½ Upper Peninsula	3	1	1	1	1	123	148	57	88	84
N. ½ Lower Peninsula	—	—	—	0	—	145	144	124	147	162
S. ½ Lower Peninsula	—	—	—	0	—	5	8	2	3	18
Total	5	2	2	1	3	366	424	218	320	333

MINNESOTA

Northern aspen-birch	14	25	31	19	24	29	24	12	19	12
Northern pine	17	18	25	17	15	2	6	7	7	5
Central hardwood	1	—	(1)	(1)	(1)	5	6	3	6	8
Prairie	1	(1)	(1)	1	3	—	(1)	—	—	—
Total	33	43	56	37	42	36	36	22	32	25

WISCONSIN

Northeastern	1	1	2	2	2	150	183	89	158	152
Northwestern	(1)	1	1	1	1	104	140	81	122	104
Central	—	(1)	1	(1)	1	136	174	71	140	121
Southwestern	—	—	—	—	—	6	3	2	3	4
Southeastern	—	—	—	—	—	4	6	1	2	2
Total	1	2	4	3	4	400	506	244	425	383
Lake States	39	47	62	41	49	802	966	484	777	741

(Table 8 continued on next page)

(Table 8 continued)

Unit	All species[2] Annual Production				
	1973	1974	1975	1976	1977
MICHIGAN					
E. ½ Upper Peninsula	365	430	241	379	390
W. ½ Upper Peninsula	483	607	323	428	458
N. ½ Lower Peninsula	535	581	523	527	516
S. ½ Lower Peninsula	27	28	11	19	39
Total	1,410	1,646	1,098	1,353	1,403
MINNESOTA					
Northern aspen-birch	789	869	761	708	693
Northern pine	429	520	459	463	480
Central hardwood	48	75	31	37	44
Prairie	3	2	(1)	1	3
Total	1,269	1,466	1,251	1,209	1,220
WISCONSIN					
Northeastern	669	761	568	712	716
Northwestern	623	692	519	622	608
Central	270	379	229	320	275
Southwestern	13	6	4	8	13
Southeastern	6	9	7	10	7
Total	1,581	1,847	1,327	1,672	1,619
Lake States	4,260	4,959	3,676	4,234	4,242

[1]Less than 500 cords.
[2]Includes small quantity of cedar not shown in other parts of table.

Table 9.—*Lake States pulpwood production from roundwood by county and species, 1977*

(In standard cords, roughwood basis)

MICHIGAN

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD
E. UPPER PENINSULA												
ALGER	452	2984	7610	11995	2314	1330	1380	105	204	6623	94	83
CHIPPEWA	168	4152	2237	13545	1382	602	5601	138	76	3497	15	16
DELTA	1023	15185	6329	6509	5348	1853	5764	303	927	35443	4146	183
LUCE	215	4247	5985	16677	1108	619	2641	50	88	2223	454	22
MACKINAC	829	5525	1693	2763	295	467	1017	46	116	4201	1699	0
MENOMINEE	400	10477	2792	268	1036	639	6763	767	3074	42760	4464	57
SCHOOLCRAFT	468	5281	4360	11544	1566	938	4152	109	178	11287	2640	0
TOTAL	3555	47851	31006	63301	11549	6448	27318	1518	4663	106034	13512	361
W. UPPER PENINSULA												
BARAGA	932	6447	6666	3062	2382	1481	2171	220	220	22521	0	317
DICKINSON	102	5061	1333	710	264	165	2007	371	1098	49026	1226	82
GOGEBIC	276	4354	6115	1440	781	437	511	64	92	17695	0	5
HOUGHTON	107	1729	2212	1525	575	168	515	25	95	4274	8	0
IRON	687	14727	5431	3875	3717	1186	8020	412	625	48357	703	73
KEWEENAW	5	30	195	85	45	8	77	1	31	80	0	0
MARQUETTE	852	11252	5091	20645	3271	1907	6620	225	540	22753	3670	41
ONTONAGON	147	1457	3964	666	514	231	284	34	96	30684	0	211
TOTAL	3108	45057	31007	32008	11549	5583	20205	1352	2787	195340	5607	729
N. LOWER PENINSULA												
ALCONA	0	0	0	310	0	0	0	0	472	25930	111	96
ALPENA	0	220	0	585	14	4	16	0	700	9184	44	67
ANTRIM	0	0	0	0	0	0	0	0	0	587	0	33
ARENAC	0	0	0	0	0	0	0	0	10	416	0	10
BENZIE	0	0	0	0	336	0	0	0	208	5824	0	208
CHARLEVOIX	0	0	0	0	671	0	0	0	0	0	0	0
CHEBOYGAN	0	131	0	3123	906	0	44	0	942	8445	44	111
CLARE	0	0	0	3190	0	0	0	0	333	15193	0	208
CRAWFORD	0	0	0	3613	98	51	0	0	107	1184	0	52
EMMET	0	0	0	711	79	42	0	0	0	434	0	0
GLADWIN	0	0	0	232	0	0	0	0	52	6244	0	52
GRAND TRAVERSE	0	0	0	1959	0	0	0	0	52	3963	0	52
IOSCO	0	0	0	11408	761	21	0	0	52	802	0	52
ISABELLA	0	0	0	0	37	0	0	0	39	3712	0	0
KALKASKA	0	12	5	3494	1607	47	0	0	104	9494	0	135
LAKE	0	0	0	5127	0	0	0	0	429	18423	0	416
LEELANAU	0	0	0	0	0	0	0	0	208	832	0	208
MANISTEE	0	0	0	0	1752	0	0	0	315	6037	0	208
MASON	0	0	0	0	37	0	0	0	52	7419	0	52
MECOSTA	0	0	0	0	2699	0	0	0	99	10790	0	52
MIDLAND	0	0	0	0	0	0	0	0	104	3457	0	67
MISSAUKEE	0	0	0	1284	629	0	0	0	53	3144	0	52
MONTMORENCY	0	295	0	8221	345	156	97	0	240	14846	67	22
NEWAYGO	0	0	0	0	6103	0	0	0	103	7896	0	0
OCEANA	0	0	0	0	3222	0	0	0	480	5123	0	208
OGEMAW	0	0	0	5688	0	0	0	0	132	3227	0	52
OSCEOLA	0	0	0	0	2205	0	0	0	45	14183	0	48
OSCODA	0	97	0	8727	241	120	32	0	206	9354	22	48
OTSEGO	0	106	0	5971	228	104	18	0	0	738	0	0
PRESQUE ISLE	0	706	58	3859	152	80	133	0	220	11400	67	22
ROSCOMMON	0	0	0	9226	0	0	0	0	1	8075	0	0
WEXFORD	0	0	0	10259	9572	42	0	0	111	5359	0	104
TOTAL	0	1567	63	86982	31694	667	340	0	5869	221715	355	2635
S. LOWER PENINSULA												
ALLEGAN	0	0	0	1154	1154	0	0	0	6	427	0	0
BARRY	0	0	0	0	240	0	0	0	0	48	0	0
CALHOUN	0	0	0	0	191	0	0	0	0	0	0	0
GRATIOT	0	0	0	0	0	0	0	0	140	584	0	0
KENT	0	0	0	0	368	0	0	0	706	928	0	0
MONTCALM	0	0	0	0	1241	0	0	0	483	3605	0	0
MUSKEGON	0	0	0	0	3797	0	0	0	8	3124	0	0
OTTAWA	0	0	0	0	3855	0	0	0	0	13	0	0
SAGINAW	0	0	0	0	52	0	0	0	1	187	0	0
WASHTENAW	0	0	0	0	114	0	0	0	0	0	0	0
TOTAL	0	0	0	1154	10922	0	0	0	1344	8916	0	0
STATE TOTAL	6663	94475	62076	183450	65714	12698	47863	2870	14663	532005	19474	3725

(Table 9 continued on next page)

TABLE 9 CONTINUED

MINNESOTA

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMA-RACK	ASH	ASPEN	BALSAM POPLAR	BASS-WOOD
NORTHERN ASPEN-BIRCH												
CARLTON	0	2142	0	4320	547	104	1064	339	0	19970	0	0
COOK	0	3763	0	3391	9	0	9742	0	0	20089	0	0
KOOCHICHING	0	22002	0	14303	1421	363	51589	19894	0	124729	6724	0
LAKE	0	9128	0	20403	592	520	19363	171	0	23341	0	0
ST.LOUIS	0	22485	0	46879	2388	1936	27907	3773	46	186948	5269	0
TOTAL	0	59520	0	89296	4957	2923	109665	24177	46	375077	11993	0
NORTHERN PINE												
AITKIN	0	1013	0	520	0	0	1195	2612	0	24077	0	400
BECKER	0	0	0	1040	0	0	0	22	0	520	0	0
BELTRAMI	0	11872	0	9901	453	78	8506	1763	0	37985	15	0
CASS	0	1770	0	14406	1056	145	1223	1083	0	50447	0	0
CLEARWATER	0	1289	0	2326	297	0	1154	2066	0	13415	0	0
CROW WING	0	104	0	6170	312	104	0	0	0	9352	0	0
HUBBARD	0	734	0	9346	699	22	460	1111	0	24706	0	0
ITASCA	0	22590	0	7125	317	106	14205	2873	0	114701	2451	0
LAKE OF THE WOODS	0	259	0	4888	54	0	12698	2364	0	9162	193	0
MAHNOMEN	0	0	0	1169	0	0	0	109	0	520	0	0
ROSEAU	0	15	0	7503	0	0	3949	1101	0	4692	0	0
WADENA	0	0	0	4464	208	0	0	0	0	2000	0	0
TOTAL	0	39646	0	68858	3396	455	43390	15104	0	291577	2659	400
CENTRAL HARDWOOD												
BENTON	0	0	0	0	0	0	0	0	0	2083	0	400
CHISAGO	0	0	0	0	0	0	0	0	0	104	0	0
HENNEPIN	0	0	0	0	0	0	0	0	0	0	0	0
KANABEC	0	0	0	0	0	0	0	0	0	2780	0	400
MILLE LACS	0	0	0	0	0	0	0	253	0	5060	0	400
MORRISON	0	0	0	1040	0	0	5	0	0	8100	0	400
OTTER TAIL	0	0	0	520	0	0	0	28	0	0	0	0
PINE	0	0	0	1377	0	0	0	0	0	12067	0	0
RAMSEY	0	0	0	0	0	0	0	0	0	0	0	0
TODD	0	0	0	574	0	0	0	0	0	0	0	0
TOTAL	0	0	0	3511	0	0	5	281	0	30194	0	1600
PRAIRIE												
POLK	0	0	0	0	0	0	0	2356	0	0	0	0
TOTAL	0	0	0	0	0	0	0	2356	0	0	0	0
STATE TOTAL	0	99166	0	161665	8353	3378	153060	41918	46	696848	14652	2000

TABLE 9 CONTINUED ON NEXT PAGE

TABLE 9 CONTINUED

WISCONSIN

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD
NORTHEASTERN												
FLORENCE	19	3958	1686	467	1614	197	993	97	75	38054	0	0
FOREST	76	12398	5093	1287	4965	139	3180	252	1570	43249	0	95
LANGLADE	0	2110	1052	124	700	3	224	377	1374	11425	0	241
LINCOLN	234	7463	3090	1407	3731	425	1488	503	1338	35745	0	1899
MARINETTE	131	7932	1488	10833	3363	311	1321	41	1027	75494	0	0
OCONTO	0	2136	362	1634	8564	400	275	9	113	27017	0	0
ONEIDA	5	12787	843	7305	8831	430	5139	275	1167	48176	0	909
SHAWANO 2/	0	869	15095	271	1037	67	0	28	773	19601	0	10
VILAS	255	6980	3196	4934	3877	1615	2785	213	108	36034	0	235
TOTAL	720	56633	31905	28260	36682	3587	15405	1795	7545	334795	0	3389
NORTHWESTERN												
ASHLAND	319	6289	2087	3094	2884	651	1292	172	1726	40127	0	274
BARRON	0	0	0	580	73	26	0	0	0	0	0	0
BAYFIELD	5	1286	128	8220	2283	195	53	1	310	61134	0	7
BURNETT	0	69	0	18020	2080	724	0	0	29	235	0	0
DOUGLAS	0	206	0	27065	4868	276	22	163	89	21718	0	0
IRON	24	826	757	896	543	162	274	61	380	50026	0	453
POLK	0	0	0	1355	8	5	0	0	0	0	0	0
PRICE	140	3684	1865	1244	3259	276	776	493	3125	36145	0	1794
RUSK	0	265	288	87	5	0	10	36	745	8361	0	280
SAWYER	2	814	2306	3905	2264	267	475	41	2178	40574	0	351
TAYLOR	52	1593	1019	286	659	92	199	444	1637	21233	55	674
WASHBURN	0	56	0	13947	1880	665	58	68	111	48848	0	0
TOTAL	542	15088	8450	78699	20806	3339	3159	1479	10330	328401	55	3833
CENTRAL												
ADAMS	0	0	0	21114	5066	570	0	0	8	84	0	0
CHIPPEWA	8	76	440	207	458	15	18	305	577	8641	0	503
CLARK	0	49	128	1621	1109	1005	0	42	259	1960	0	49
EAU CLAIRE	0	0	0	3888	1309	0	0	0	16	349	0	0
JACKSON	0	0	0	12836	3294	500	0	6	54	79	0	0
JUNEAU	0	0	0	16549	3936	322	0	26	112	482	0	0
MARATHON	0	1457	2290	927	864	167	15	108	572	7453	0	113
MARQUETTE	0	0	0	1690	1274	73	0	68	63	0	0	0
MONROE	0	0	0	3214	1444	167	0	0	72	24	0	0
PORTAGE	0	19	204	3047	2481	975	0	26	9	3294	0	0
WAUPACA	0	9	54	995	1322	337	0	41	235	6727	0	0
WAUSHARA	0	0	0	3121	4410	396	0	83	18	150	0	0
WOOD	0	0	0	9278	1548	1372	6	0	256	2425	0	19
TOTAL	8	1610	3116	78487	28515	5899	39	705	2251	31668	0	684
SOUTHWESTERN												
BUFFALO	0	0	0	66	64	5	0	0	0	0	0	0
CRAWFORD	0	0	0	0	0	0	0	0	0	30	0	0
DUNN	0	0	0	964	1035	80	0	0	0	0	0	0
GRANT	0	0	0	7	6	0	0	0	116	665	0	273
IOWA	0	0	0	61	60	16	0	0	0	0	0	0
LACROSSE	0	0	0	362	445	90	0	0	0	0	0	0
PEPIN	0	0	0	20	18	14	0	0	0	0	0	0
RICHLAND	0	0	0	18	0	41	0	0	0	0	0	0
SAUK	0	0	0	933	2114	171	0	0	2	0	0	0
TREMPEALEAU	0	0	0	732	699	41	0	0	0	0	0	0
TOTAL	0	0	0	3163	4441	458	0	0	118	695	0	273
SOUTHEASTERN												
BROWN	0	0	0	9	40	3	0	0	0	0	0	0
COLUMBIA	0	0	0	104	1232	0	0	0	176	0	0	0
DANE	0	0	0	54	3	0	0	0	0	0	0	0
GREEN	0	0	0	29	315	45	0	0	0	0	0	0
GREEN LAKE	0	0	0	2	8	1	0	0	0	0	0	0
MANITOWOC	0	0	0	0	0	0	0	0	0	5	0	0
OUTAGAMIE	0	0	0	10	42	3	0	0	72	660	0	0
ROCK	0	0	0	9	2	0	0	0	0	0	0	0
WAUKESHA	0	0	0	968	1216	80	0	0	0	0	0	0
TOTAL	0	0	0	1185	2858	132	0	0	248	665	0	0
STATE TOTAL	1270	73331	43471	189794	93302	13415	18603	3979	20492	696224	55	8179

TABLE 9 CONTINUED ON NEXT PAGE

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1977.
2/ INCLUDES MENOMINEE COUNTY.

TABLE 9 CONTINUED

MICHIGAN

UNIT AND COUNTY	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD-WOODS	ALL SPECIES
E. UPPER PENINSULA												
ALGER	2198	2917	708	0	613	0	2288	3759	57	0	67	48281
CHIPPEWA	392	693	176	0	112	0	905	654	27	0	11	34398
DELTA	1003	5758	1296	0	2040	0	5640	5004	226	0	195	102175
LUCE	879	1084	242	0	297	0	1566	1043	50	0	21	39421
MACKINAC	810	1458	42	0	222	0	513	394	0	0	26	22616
MENOMINEE	291	3704	1240	0	1215	0	4909	3580	100	0	495	93531
SCHOOLCRAFT	425	2384	377	0	511	0	1837	910	121	0	54	49142
TOTAL	5998	17997	4081	0	4420	0	18158	15344	581	0	869	389564
W. UPPER PENINSULA												
BARAGA	0	1997	2004	0	1948	0	6812	3546	100	0	356	63202
DICKINSON	89	3296	718	0	1490	0	3710	1966	111	0	193	73018
GOGEBIC	0	533	1597	0	1618	0	3227	1229	4	0	321	40349
HOUGHTON	0	676	1060	0	1177	0	2342	893	6	0	221	17608
IRON	0	2256	4233	0	5234	0	10934	4716	125	0	901	116712
KEWEENAW	0	25	14	0	93	0	343	82	0	0	8	1062
MARQUETTE	36	6543	1628	0	1632	0	5986	3755	365	0	160	96972
ONTONAGON	0	462	1655	0	1653	0	3209	3222	0	0	334	49323
TOTAL	125	16288	12909	0	14865	0	37113	19409	711	0	2494	458246
N. LOWER PENINSULA												
ALCONA	86	1609	0	0	0	0	110	2555	9997	1150	16	42442
ALPENA	100	1056	0	0	0	0	160	2997	696	110	0	15953
ANTRIM	0	0	0	0	0	0	0	104	0	0	0	724
ARENAC	0	60	0	0	0	0	0	52	0	0	7	555
BENZIE	104	440	0	0	0	0	104	2600	728	104	40	10696
CHARLEVOIX	0	0	0	0	0	0	0	0	0	0	0	671
CHEBOYGAN	140	521	0	0	0	0	243	3858	213	26	0	18747
CLARE	322	380	0	0	0	0	354	3485	8097	507	161	32230
CRAWFORD	104	78	0	0	0	0	32	1109	3854	150	26	10458
EMMET	0	58	0	0	0	0	0	89	0	0	0	1413
GLADWIN	7	670	0	0	0	0	0	742	1040	104	0	9143
GRAND TRAVERSE	104	139	0	0	0	0	104	759	111	53	52	7338
IOSCO	0	19	0	0	0	0	0	728	477	50	0	14370
ISABELLA	12	33	0	0	0	0	70	245	1342	258	4	5752
KALKASKA	208	215	0	0	0	0	52	2080	2080	208	52	19793
LAKE	417	131	0	0	0	0	231	7385	14245	677	104	47585
LEELANAU	104	58	0	0	0	0	104	208	297	104	104	2227
MANISTEE	306	291	0	0	0	0	347	4337	2970	430	129	17122
MASON	124	385	0	0	0	0	104	3208	4314	114	93	15902
MECOSTA	38	114	0	0	0	0	121	318	2350	152	10	16743
MIDLAND	52	226	0	0	0	0	0	1144	416	0	0	5466
MISSAUKEE	52	197	0	0	0	0	3	1055	1666	155	52	8342
MONTMORENCY	40	853	0	0	0	0	60	1214	4658	410	0	31324
NEWAYGO	81	107	0	0	0	0	155	667	4629	966	13	20720
OCEANA	448	72	0	0	0	0	732	442	2351	867	144	14089
OGEMAW	104	210	0	0	0	0	20	727	3050	630	47	13887
OSCEOLA	55	291	0	0	0	0	101	825	2396	353	6	20508
OSCODA	46	508	0	0	0	0	66	1215	2604	281	89	23256
OTSEGO	0	0	0	0	0	0	0	0	110	0	0	7225
PRESQUE ISLE	20	1933	0	0	0	0	40	1303	1253	159	0	21405
ROSCOMMON	0	151	0	0	0	0	2	1152	4736	64	0	23407
WEXFORD	104	164	0	0	0	0	118	4747	5151	309	135	36125
TOTAL	3178	10859	0	0	0	0	3433	51350	85831	8391	1284	516218
S. LOWER PENINSULA												
ALLEGAN	0	12	0	0	0	0	12	60	420	90	0	3335
BARRY	0	0	0	0	0	0	0	0	0	0	0	288
CALHOUN	0	0	0	0	0	0	0	0	0	0	0	101
GRATIOT	50	0	0	0	0	0	110	271	279	174	43	1651
KENT	315	1	0	0	0	0	685	1172	2694	1611	215	8695
MONTCALM	180	15	0	0	0	0	438	1352	3741	1956	183	13194
MUSKEGON	0	16	0	0	0	0	16	80	605	154	0	7800
OTTAWA	0	0	0	0	0	0	0	0	0	0	0	3868
SAGINAW	0	2	0	0	0	0	2	13	88	19	0	364
WASHTENAW	0	0	0	0	0	0	0	0	0	0	0	114
TOTAL	545	46	0	0	0	0	1263	2948	7827	4004	441	39410
STATE TOTAL	9846	45190	16990	0	24285	0	59967	89051	94950	12395	5088	1403438

MINNESOTA

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMA RACK	ASH	ASPEN	BALSAM POPLAR	BASS WOOD
NORTHERN ASPEN-BIRCH												
CARLTON	0	3139	0	0	0	0	20	9	0	0	0	31654
COOK	0	0	0	0	0	0	0	0	0	0	0	36994
KOOCHICHING	0	1906	0	0	0	0	37	44	0	0	0	243012
LAKE	0	3211	0	0	0	0	0	0	0	0	0	75729
ST.LOUIS	0	8114	3	0	59	0	41	169	0	0	0	306017
TOTAL	0	15370	3	0	59	0	98	222	0	0	0	693406
NORTHERN PINE												
AITKIN	0	1416	0	0	75	0	0	75	941	38	0	32362
BECKER	0	0	0	0	0	0	0	0	0	0	0	1582
BELTRAMI	0	4202	0	0	0	0	164	8	0	0	0	74947
CASS	0	2550	0	0	0	0	29	7	0	0	0	72716
CLEARWATER	0	552	0	0	0	0	75	6	0	0	0	21180
CROW WING	0	624	0	0	0	0	0	0	0	0	0	16666
HUBBARD	0	1040	0	0	0	0	0	0	0	0	0	38118
ITASCA	0	1164	0	0	0	0	160	46	0	0	0	165738
LAKE OF THE WOODS	0	0	0	0	0	0	0	0	0	0	0	29618
MAHNOMEN	0	0	0	0	0	0	0	0	0	0	0	1798
ROSEAU	0	1040	0	0	0	0	0	0	0	0	0	18300
WADENA	0	104	0	0	0	0	0	0	0	0	0	6776
TOTAL	0	12692	0	0	75	0	428	142	941	38	0	479801
CENTRAL HARDWOOD												
BENTON	0	376	0	0	75	0	0	75	941	38	0	3988
CHISAGO	0	0	0	0	0	0	0	0	0	0	0	104
HENNEPIN	0	0	0	0	944	0	0	0	0	0	0	944
KANABEC	0	376	0	0	75	0	0	75	941	38	0	4685
MILLE LACS	0	376	0	0	75	0	0	75	941	38	0	7218
MORRISON	0	376	0	0	75	0	0	75	941	38	0	11050
OTTER TAIL	0	0	0	0	0	0	0	0	0	0	0	548
PINE	0	474	0	0	0	0	0	0	0	0	0	13918
RAMSEY	0	0	0	0	944	0	0	0	0	0	0	944
TODD	0	0	0	0	0	0	0	0	0	0	0	574
TOTAL	0	1978	0	0	2188	0	0	300	3764	152	0	43973
PRAIRIE												
POLK	0	0	0	0	0	0	0	0	0	0	0	2356
TOTAL	0	0	0	0	0	0	0	0	0	0	0	2356
STATE TOTAL	0	30040	3	0	2322	0	526	664	4705	190	0	1219536

TABLE 9 CONTINUED ON NEXT PAGE

TABLE 9 CONTINUED

WISCONSIN

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD-WOODS	ALL SPECIES
NORTHEASTERN												
FLORENCE	0	1476	328	0	16552	0	1664	10244	372	0	103	77897
FOREST	2	3136	1060	0	8507	0	9180	1835	17	0	2094	98135
LANGLADE	0	2039	901	0	14126	78	7916	6268	493	0	1243	50744
LINCOLN	0	3221	503	0	9108	0	2395	6024	1052	0	110	79736
MARINETTE	0	11367	165	0	2585	0	1130	1648	0	0	308	119144
OCONTO	0	2092	67	0	323	10	329	321	0	0	11	43663
ONEIDA	0	15314	2104	0	2186	2	3087	4357	2558	0	222	115697
SHAWANO 2/	0	485	409	0	6001	600	2618	1146	14	0	427	49451
VILAS	0	8459	648	0	4399	0	3668	3367	558	4	90	81425
TOTAL	2	47589	6185	0	63837	690	31987	35210	5064	4	4608	715892
NORTHWESTERN												
ASHLAND	0	2314	481	0	3433	0	4335	2493	133	0	285	72389
BARRON	0	478	0	0	0	0	0	0	0	0	0	1157
BAYFIELD	0	12540	1027	0	523	0	732	452	513	60	61	89530
BURNETT	0	41	10	0	31	0	48	45	0	0	2	21334
DOUGLAS	0	2207	51	0	70	0	123	91	0	0	6	56955
IRON	0	2275	136	0	2555	0	646	1738	222	0	18	61992
POLK	0	0	0	0	0	0	0	0	0	0	0	1368
PRICE	0	7034	983	0	16805	0	4738	3173	876	30	303	86743
RUSK	0	2578	336	0	5476	0	1452	3700	545	7	55	24226
SAWYER	0	5620	627	0	7615	0	4328	4677	915	14	349	77322
TAYLOR	0	4014	627	0	8800	0	3835	2386	372	8	129	48114
WASHBURN	0	642	42	0	88	0	150	114	0	0	8	66677
TOTAL	0	39743	4320	0	45396	0	20387	18869	3576	119	1216	607807
CENTRAL												
ADAMS	0	7	3	0	13	0	8	22	6163	1685	1	34744
CHIPPEWA	0	1328	524	0	1286	0	781	1027	261	0	22	16477
CLARK	0	334	113	0	475	0	366	583	8911	2286	35	19325
EAU CLAIRE	0	24	5	0	26	0	19	42	62	18	3	5761
JACKSON	0	108	24	0	103	0	98	160	870	235	10	18377
JUNEAU	0	211	49	0	207	0	200	318	3875	1142	15	27444
MARATHON	1	564	210	0	35101	20	2190	22941	2230	0	161	77384
MARQUETTE	0	47	9	0	1898	0	354	1163	0	0	25	6664
MONROE	0	193	45	0	169	0	218	281	0	0	1	5828
PORTAGE	0	18	3	0	67	0	142	274	3744	1069	1	15373
WAUPACA	0	247	108	0	906	66	525	506	0	0	54	12132
WAUSHARA	0	84	17	0	52	0	84	86	522	152	0	9175
WOOD	0	237	72	0	345	0	215	504	8266	2162	22	26627
TOTAL	1	3402	1182	0	40648	86	5200	27907	34904	8749	350	275311
SOUTHWESTERN												
BUFFALO	0	0	0	0	0	0	0	0	0	0	0	135
CRAWFORD	0	0	0	0	0	0	0	0	0	0	0	30
DUNN	0	0	0	0	0	0	0	0	0	0	0	2079
GRANT	0	223	0	44	512	253	219	302	1657	623	105	5005
IOWA	0	0	0	0	0	0	0	0	0	0	0	137
LACROSSE	0	0	0	0	0	0	0	0	0	0	0	897
PEPIN	0	0	0	0	0	0	0	0	0	0	0	52
RICHLAND	0	0	0	0	0	0	0	0	0	0	0	59
SAUK	0	3	0	0	7	0	4	4	0	0	1	3239
TREMPEALEAU	0	0	0	0	0	0	0	0	0	0	0	1472
TOTAL	0	226	0	44	519	253	223	306	1657	623	106	13105
SOUTHEASTERN												
BROWN	0	0	0	0	0	0	0	0	0	0	0	52
COLUMBIA	6	29	9	0	259	0	121	94	0	0	88	2114
DANE	0	0	0	0	0	0	0	0	0	0	0	57
GREEN	0	0	0	0	0	0	0	0	0	0	0	389
GREEN LAKE	0	0	0	0	0	0	0	0	0	0	0	11
MANITOWOC	0	0	0	0	0	0	0	0	0	0	0	5
OUTAGAMIE	0	360	72	0	216	0	360	360	0	0	0	2155
ROCK	0	0	0	0	0	0	0	0	0	0	0	11
WAUKESHA	0	0	0	0	0	0	0	0	0	0	0	2264
TOTAL	6	385	81	0	475	0	481	454	0	0	88	7058
STATE TOTAL	9	91345	11768	44	150775	1029	58278	82746	45201	9495	6368	1619173

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1977.
2/ INCLUDES MENOMINEE COUNTY.

Table 10. — *Central States pulpwood production by State and destination, 1973-1977*
(In thousand standard cords, roughwood basis)

Year	Illinois			Indiana			Iowa			Missouri		
		Destination			Destination			Destination			Destination	
	Total	Central States	Other States	Total	Central States	Other States	Total	Central States	Other States	Total	Central States	Other States
1973	146	124	22	148	80	68	48	46	2	112	63	49
1974	131	98	33	159	84	75	59	57	2	137	77	60
1975	105	60	45	135	58	77	50	48	2	116	43	73
1976	116	65	51	172	78	94	45	41	4	132	55	77
1977	111	53	58	161	66	95	50	46	4	123	44	79

Table 11. — *Trends in receipts of roundwood and residue as pulpwood, Central States, 1973-1977*
(In thousand standard cords, roughwood basis)

Type of Material and Area	1973	1974	1975	1976	1977
Roundwood					
Illinois	70	56	13	18	24
Indiana, Iowa, Missouri	106	93	74	81	62
Total	176	149	86	99	86
Residue					
Illinois	122	104	64	71	62
Indiana, Iowa, Missouri	81	100	86	102	98
Total	203	204	150	173	160
All Material	379	353	236	272	246

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-666-980/315 REG.#6

Blyth, James E., and W. Brad Smith.

1979. Pulpwood production in the north central region by county, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-41, 23 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, Minnesota.

Discusses 1977 pulpwood production and receipts and recent production in the Lake States and Central States. Shows pulpwood production in the Lake States (Michigan, Minnesota, and Wisconsin) by species for each county and compares production by Forest Survey Unit with that of previous years. Presents 1977 pulpwood production and receipts data by State for the Central States (Illinois, Indiana, Iowa, and Missouri), and shows four production classes by county.

OXFORD: 861.0(77):792. KEY WORDS: roundwood, residue, receipts, Lake States, Central States.

Blyth, James E., and W. Brad Smith.

1979. Pulpwood production in the north central region by county, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-41, 23 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, Minnesota.

Discusses 1977 pulpwood production and receipts and recent production in the Lake States and Central States. Shows pulpwood production in the Lake States (Michigan, Minnesota, and Wisconsin) by species for each county and compares production by Forest Survey Unit with that of previous years. Presents 1977 pulpwood production and receipts data by State for the Central States (Illinois, Indiana, Iowa, and Missouri), and shows four production classes by county.

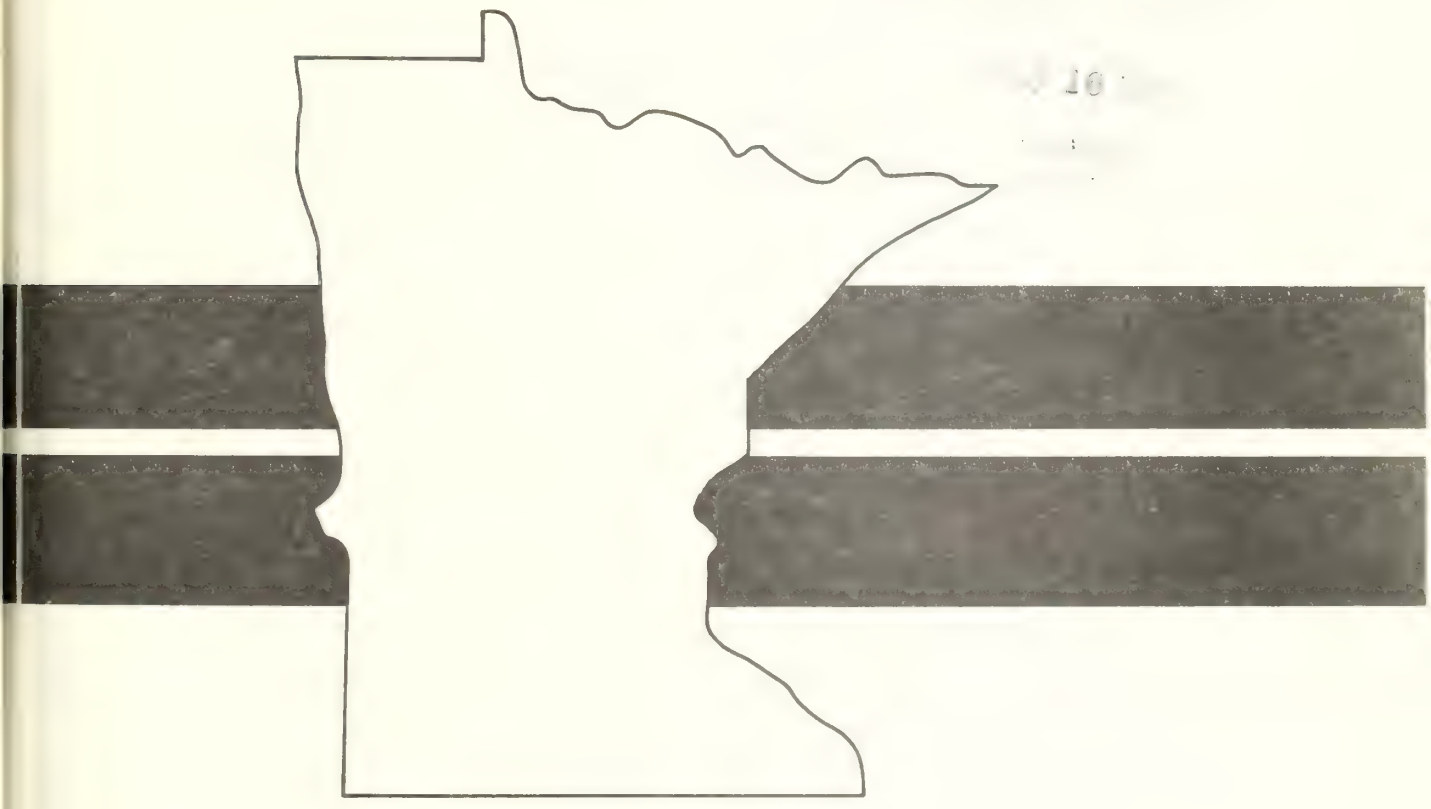
OXFORD: 861.0(77):792. KEY WORDS: roundwood, residue, receipts, Lake States, Central States.

More bicycles and shoe leather...less smog.

USDA FOREST SERVICE
RESOURCE BULLETIN NC-42

CLEMSON UNIVERSITY LIBRARY
AUG 17 1979
SCI., TECH. & AGR. DIV.

Minnesota's Tax-forfeited Land:



Some TRENDS in timber harvested and stumpage prices

David C. Lothner
Edwin Kallio
David T. Davis

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

ACKNOWLEDGMENT

The authors wish to thank the individual county land commissioners and auditors, the office of Iron Range Resources and Rehabilitation, and the Minnesota Department of Natural Resources for their cooperation.

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service — U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication March 26, 1979
1979

MINNESOTA'S TAX-FORFEITED LAND: SOME TRENDS IN TIMBER HARVESTED AND STUMPAGE PRICES

David C. Lothner, *Economist,*
Edwin Kallio, *Principal Market Analyst,*
and **David T. Davis,** *Forestry Technician*
Duluth, Minnesota

The area of commercial forest land in Minnesota has been decreasing steadily during recent years.[1] Consequently, interest has been increasing in the availability of timber from all land — both public and private. And tax-forfeited land is no exception.[2] Concern focuses on the following questions: How much timber has been harvested from tax-forfeited land in Minnesota? What direction will harvest trends take in the future? Could these trends be markedly increased if greater investments were made in county forest land? Answers to these questions are difficult to secure. However, some insight can be gained by examining past trends in harvest levels from county land.[3,4]

The purpose of this bulletin is to illustrate recent trends in the volume and value of timber harvested from county-administered land and to highlight the significant changes for the 1960-1975 period.

All County Trends

Total timber harvested from tax-forfeited land in the 16 northern Minnesota counties — Aitkin, Becker, Beltrami, Carlton, Cass, Clearwater, Cook, Crow Wing, Hubbard, Itasca, Koochiching, Lake, Mahnomen, Pine, St. Louis, Wadena — increased from 145,000 cord equivalents in 1960 to 235,000 cord equivalents in 1975 (fig. 1)[5]. Although vacillating from year to year, the average rate of increase in total harvest averaged about 3 percent annually. Most of the timber harvested is pulpwood, but some sawtimber and bolts are also harvested. For example, in 1975, the 235,000 cord equivalents consisted of 213,600 cords of pulpwood, 13,000 cords of bolts, and 8.5 million board feet of sawtimber. The all-time peak harvest during the period was 319,000 cord equivalents in 1974. This occurred simultaneously with the rapid economic expansion in the total economy prior to the 1975 recession.

Throughout the period, the harvest of hardwoods exceeded that of softwoods. The hardwoods increased from almost 84,000 cords or 58 percent of the total harvest in 1960 to 167,000 cords or 71 percent of the total harvest in 1975. The average rate of increase in hardwood harvest averaged about 5 percent per year for the period. Aspen

[1]*Unpublished 1975 Minnesota forest inventory results by the North Central Forest Experiment Station.*

[2]*This land, although commonly referred to as county land, is actually state land held in trust for the county governments. The land was once privately owned and went tax delinquent when the owners failed to pay the property taxes. Thus, it forfeited back to the state, which gave the provision for its management to the counties.*

[3]*Stone, Robert N. 1966. A third look at Minnesota's timber. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-1, 64 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

[4]*Lothner, David C., Edwin Kallio, and David T. Davis. 1978. Minnesota's tax-forfeited land: some trends in acreages, sales, and prices. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-37, 6 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

[5]*Statistics are based on data collected from the Iron Range Resources and Rehabilitation Board, State of Minnesota and the individual county offices.*

has always been the number one species harvested in terms of volume. Almost 76,000 cords or 93 percent of the hardwood volume harvested in 1960 was aspen. By 1975, 146,000 cords of aspen were harvested and this represented about 88 percent of the hardwood volume. Therefore, the hardwoods other than aspen appear to be gaining but are still of minor importance.

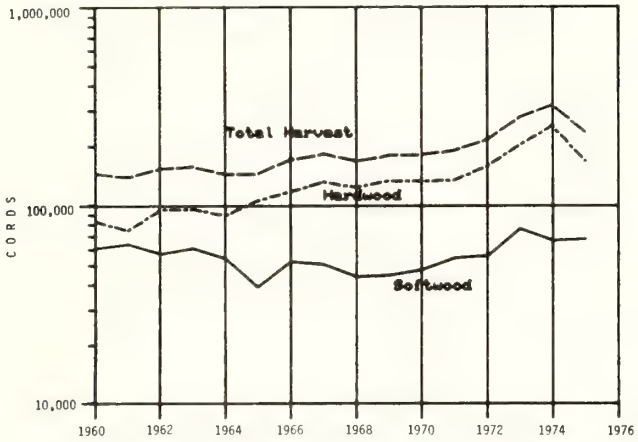


Figure 1.—*All species of timber harvested from county land in 16 northern Minnesota counties, 1960-1975.*

In 1960, about 61,000 cord equivalents of softwood were harvested; in 1975, almost 68,000 cord equivalents were harvested. Thus, the average rate of increase in the softwood harvest was <1 percent per year. However, looking at the entire period, the softwood harvest declined from 1960 to 1968 to a low of 44,000 cord equivalents and then steadily increased at a rate of about 6 percent from 1968 through 1975.

In contrast with the hardwoods, no single dominant softwood species was harvested. Jack pine, balsam fir, and the spruces are presently ranked in that order, accounting for 37, 34, and 18 percent of the total softwood harvest, respectively. Thus, these three account for about 89 percent of the total softwood harvest. (See the Appendix for a tabular breakdown of individual species harvested by year.)

The stumpage value of timber harvested in actual dollars from tax-forfeited land increased from about $310,000 in 1960 to about $671,000 in 1975 (fig. 2). Most of this increase took place after 1969.

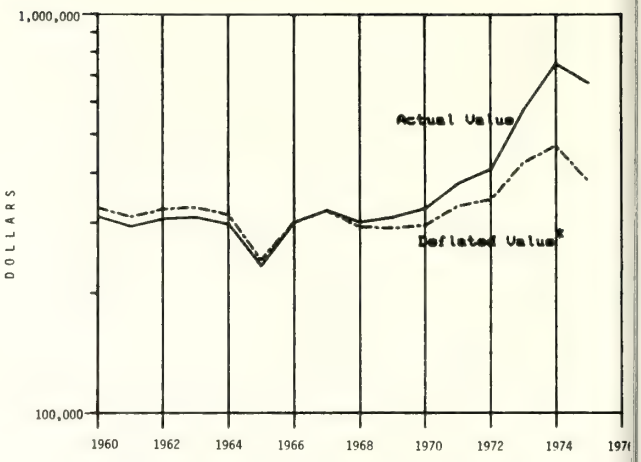


Figure 2.— *Value of all species of timber harvested from tax-forfeited land in 16 northern Minnesota counties, 1960-1975.*

Through the 1960's, the value of timber harvested in actual dollars remained essentially constant at around $300,000 per year and then in the 1970's began increasing sharply.

Most of the timber was sold informally upon request of loggers at appraised values determined by the county land department. Thus, there has been little competition based upon price for this material. Only four of the counties — Cass, Clearwater, Koochiching, and St. Louis — were selling timber on an auction basis and only Cass County used the auction sale to any significant degree. Thus, it is not surprising that the stumpage price of timber sold aggregated and weighted for all species has increased little in actual dollars and decreased in real (deflated) dollars.

During the 1960's the average price of timber per unit harvested actually decreased — from $2.15 per cord in 1960 to about $1.75 per cord in 1969 (fig. 3). After 1969, the value per cord in actual dollars began increasing and was $2.85 by 1975.

This trend is primarily due to: (1) a shift in the type of wood harvested — proportionally more low-value hardwoods (mainly aspen) and less high-value softwoods; and (2) the stumpage price of the more valuable softwood species (red and white pine jack pine, spruce, and balsam fir) remained essentially constant throughout the 1960's and increasing in actual dollars only in the 1970's (fig. 3).

When the harvest is valued in real dollars using the wholesale price index for all commodities as a

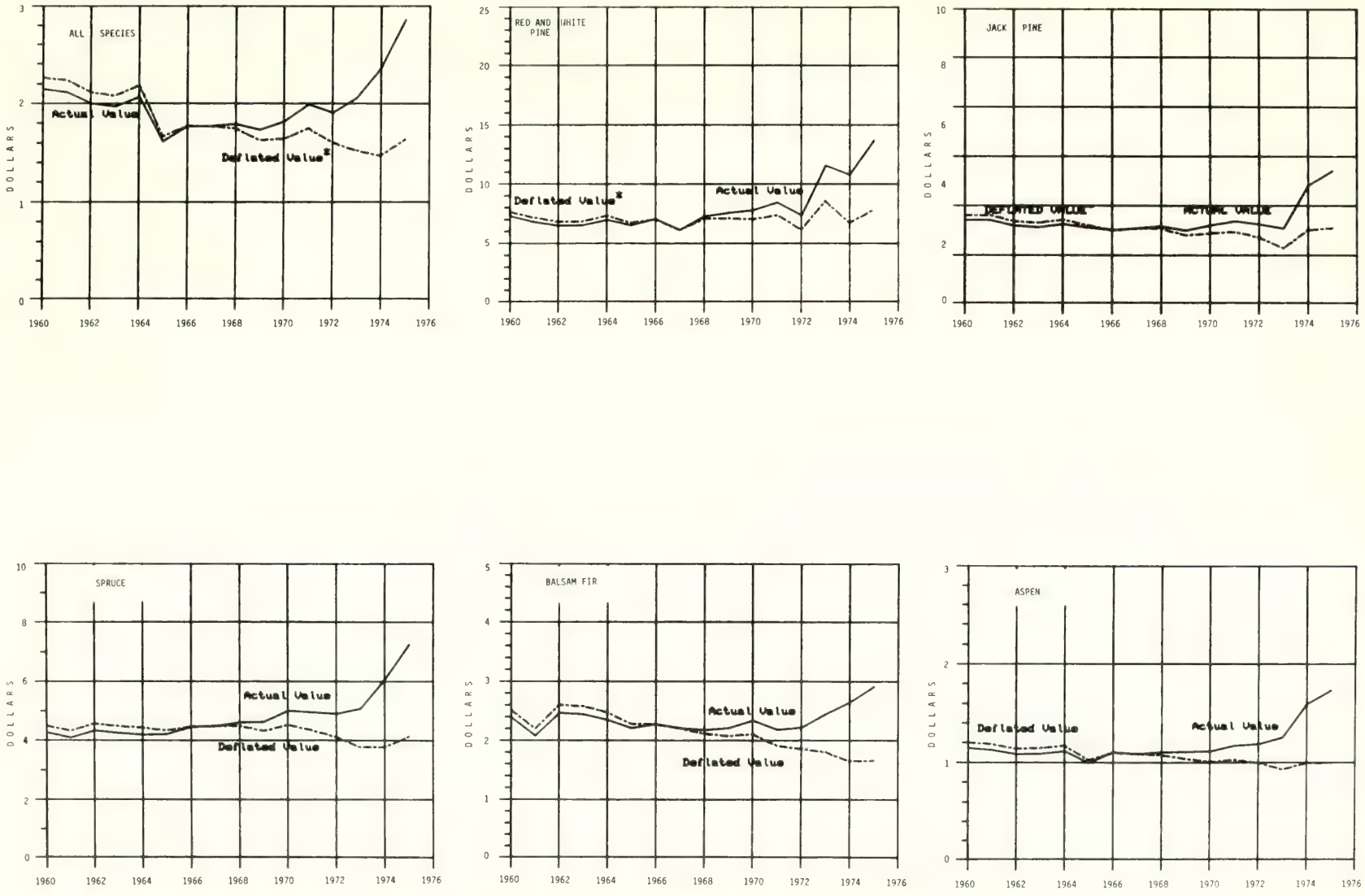


Figure 3.— *Average stumpage price per cord for timber harvested in 16 northern Minnesota counties, 1960-1975. (Deflated value determined by wholesale price index (1967 = 100).)*

deflator (base year is 1967), the trends in stumpage price become even more startling. The average price per unit aggregated and weighted for all species actually decreased in real dollars throughout the entire period. It was $2.27 per cord in 1960 (1967 dollars) and decreased steadily to $1.63 per cord by 1975. Again, the same two factors influence the decrease. First, the type of wood harvested shifted to proportionally more of the low-value hardwoods and less of the high-value softwoods. Second, the stumpage price in real dollars remained essentially constant or slightly declined throughout the entire period for the more valuable softwood species.

Individual County Trends

The annual volumes of timber harvested from tax-forfeited land within individual counties differed greatly from year to year as well as from county to county. Six counties accounted for 81 percent of the total timber harvested from tax-forfeited land in 1975: Koochiching, 60,000 cords; St. Louis, 43,000 cords; Itasca, 40,000 cords; Cass, 29,000 cords; Beltrami, 14,000 cords; and Aitkin, 10,000 cords.

Timber volume harvested in St. Louis, Beltrami, and Aitkin Counties fluctuated from year to year but showed no discernable trend for the 1960 through 1975 period (fig. 4). Timber volume harvested in Cass, Koochiching, and Itasca Counties, on the other hand, increased at an annual rate of 12, 8, and 3 percent, respectively, during the period (fig. 4).

Many of the other northern Minnesota counties have been developing their timber management programs and together make a significant contribution to the total timber harvest.

How do these six individual counties compare with respect to the hardwood and softwood harvest mix? Aitkin, Koochiching, and St. Louis Counties harvested more hardwoods than softwoods each year during the period. In 1960, the softwood harvest in Itasca and Cass Counties was slightly higher than the hardwood harvest, but by 1965 in Itasca County and 1969 in Cass County hardwoods had become the predominant species group. In Beltrami County hardwoods and softwoods alternated as the predominantly harvested species group.

The big four counties, both in terms of area and harvest volumes (St. Louis, Itasca, Koochiching, and Cass), all increased their hardwood harvest share with respect to their total harvest during the period. They began the period with hardwood shares ranging from 45 to 60 percent and ended the period with hardwood shares ranging from 70 to 75 percent. Three of the big four counties had a substantial increase in the average annual rate of hardwood harvest. Cass County averaged 16 percent followed by Koochiching (9 percent), and Itasca (6 percent). St. Louis County, along with Aitkin and Beltrami, showed no discernable trend.

Only Cass and Koochiching Counties increased their softwood harvest during the period and both had average annual rates of increase of about 6 percent. Itasca County averaged a 7 percent rate of decrease for the first 10 years and averaged a 10 percent rate of increase for the last 5 years. Still, Itasca County was harvesting less softwoods at the end than it was at the beginning of the period. Beltrami County had little discernable softwood harvest trend although it fluctuated sharply from year to year. The softwood harvest in both Aitkin and St. Louis Counties decreased an average of about 3 percent per year during the period.

The average stumpage price trends for all timber sold by the individual counties is *not* substantially different than the trend for all sixteen counties combined. Of the six counties that accounted for most of the timber harvested, five — Aitkin, Cass, Itasca, Koochiching, and St. Louis — had a decreasing average stumpage price per unit in actual dollars during the 1960's (fig. 5). Only Beltrami County, which had alternating periods of softwoods and then hardwoods predominating its annual harvest, had average stumpage prices with no discernable trend during the 1960's (fig. 5). Average stumpage price increased for all six counties in the 1970's.

When the harvest is valued in real dollars, using the wholesale price index for all commodities as a deflator, the average stumpage price trends for the individual counties again is similar to the trend for all 16 counties combined. All counties, except Beltrami which shows no discernable trend, have a decreasing average stumpage price throughout the period.

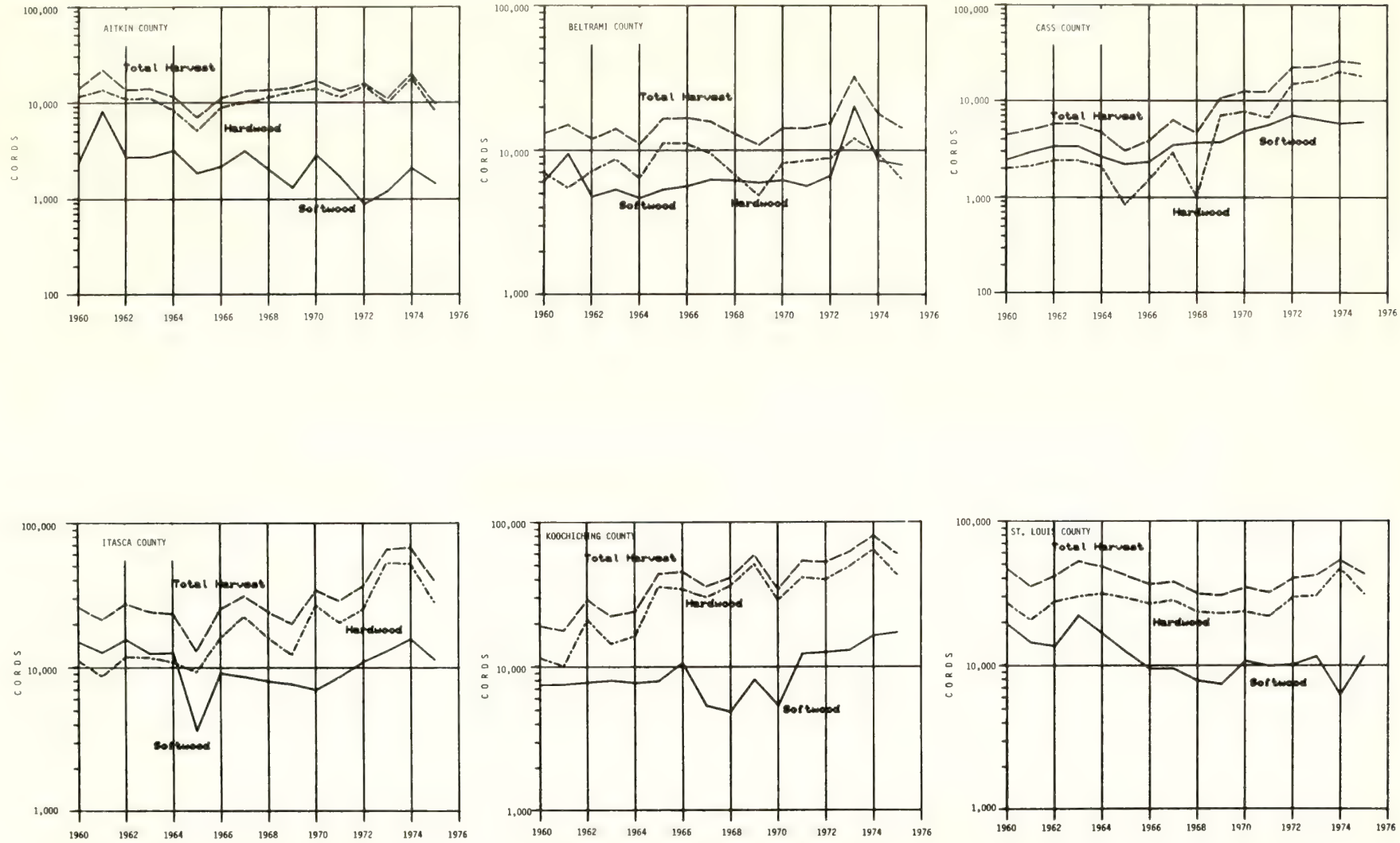


Figure 4.— *Timber harvested from county land in six northern Minnesota counties, 1960-1975.*

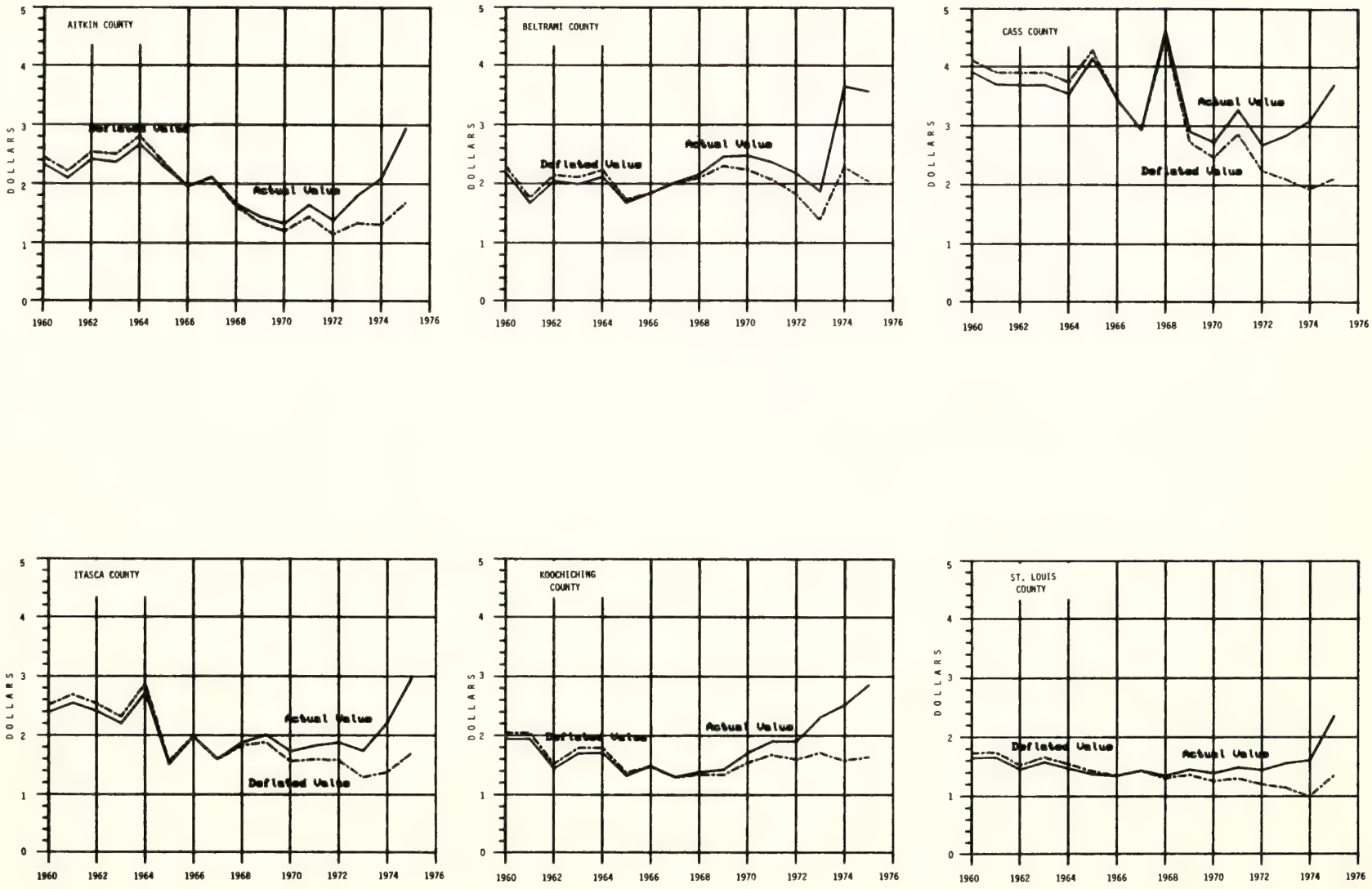


Figure 5.— *Average stumpage price per cord for timber harvested in six northern Minnesota counties, 1960-1975, all species. (Deflated value determined by*

No discernable trend is apparent for the average stumpage prices in actual dollars for the individual softwood species within each county in the 1960's followed by an increasing trend in the 1970's (figs. 6, 7, 8, and 9). However, there are some notable exceptions. (1) The stumpage prices for the red and white pine, jack pine, and spruce categories in Beltrami County vary from the all-county aggregates. Red and white pine and jack pine prices vary greatly from year-to-year in the 1970's and show no discernable trend. Spruce prices appear almost constant with a sharp drop in 1975. (2) Jack pine stumpage prices in St. Louis County show no increase in the 1970's so no discernable trend is apparent throughout the 1960 to 1975 period. (3) Balsam fir stumpage prices in Aitkin and Cass Counties decreased in the 1960's before increasing in the 1970's to early 1960 levels by 1975. A further review of the information in figures 4 through 10 will permit the reader to make additional observations about the counties.

In summary, the total volume of timber harvested on county-administered tax-forfeited land has increased significantly from 1960 to 1975. This was primarily due to the increased harvest of aspen. Prices paid for stumpage generally did not change throughout the 1960's and increased slightly in the 1970's. When these prices are deflated to indicate real dollars, prices have actually declined slightly throughout the entire period.

APPENDIX

TOTAL TIMBER HARVESTED
(Cords)
Sum of 16 Northern Minnesota Counties

SOFTWOODS

Year	Red and White Pine	Jack Pine	Spruce	Balsam Fir	Tamarack	Cedar	Total Softwoods
1960	2,116	23,113	13,976	18,339	2,374	1,326	61,244
1961	2,549	21,542	16,038	17,959	5,449	544	64,081
1962	2,926	26,639	11,228	13,923	2,717	16	57,449
1963	2,831	23,661	13,596	15,051	5,762	90	60,991
1964	4,269	19,371	14,206	11,623	4,747	73	54,289
1965	1,700	15,543	8,245	10,908	2,683	58	39,137
1966	1,678	22,781	10,375	15,612	1,665	264	52,375
1967	4,068	19,540	10,959	9,563	6,414	99	50,643
1968	3,747	22,881	6,875	6,015	4,250	285	44,053
1969	3,354	25,562	7,759	5,040	2,741	324	44,780
1970	3,280	23,753	8,139	7,173	4,947	195	47,487
1971	4,664	26,383	10,042	7,592	4,988	922	54,591
1972	6,156	25,526	10,618	11,380	1,743	340	55,763
1973	6,636	38,534	13,895	13,749	2,741	913	76,468
1974	5,918	24,676	14,989	17,277	2,652	1,378	66,890
1975	4,137	25,301	12,308	22,857	2,169	1,123	67,895

HARDWOODS

Year	Aspen	Birch	Ash	Oak	Basswood	Other Hardwoods	Total Hardwoods	Total All Species
1960	77,654	1,454	1,102	818	1,812	712	83,552	144,796
1961	65,248	3,749	897	1,595	2,449	1,154	75,092	139,173
1962	88,327	2,056	768	603	2,591	1,703	96,048	153,497
1963	87,833	2,409	785	2,054	1,509	1,847	96,437	157,428
1964	82,127	1,851	1,150	974	1,768	1,761	89,631	143,920
1965	94,879	1,171	942	1,059	851	7,412	106,314	145,451
1966	110,301	870	1,505	786	623	3,317	117,402	169,777
1967	122,545	1,803	1,691	904	818	3,781	131,542	182,185
1968	117,638	1,355	2,084	528	803	1,684	124,092	168,145
1969	127,247	867	1,105	668	470	3,814	134,171	178,951
1970	120,366	5,335	1,832	547	723	3,715	132,518	180,005
1971	119,516	6,163	1,739	1,834	921	4,858	135,031	189,622
1972	141,708	8,643	1,118	1,619	499	5,188	158,775	214,538
1973	171,646	7,189	1,517	1,189	341	17,271	199,153	275,621
1974	225,507	10,896	2,043	1,158	1,048	11,416	252,068	318,958
1975	146,360	8,054	1,504	1,855	371	9,097	167,241	235,136

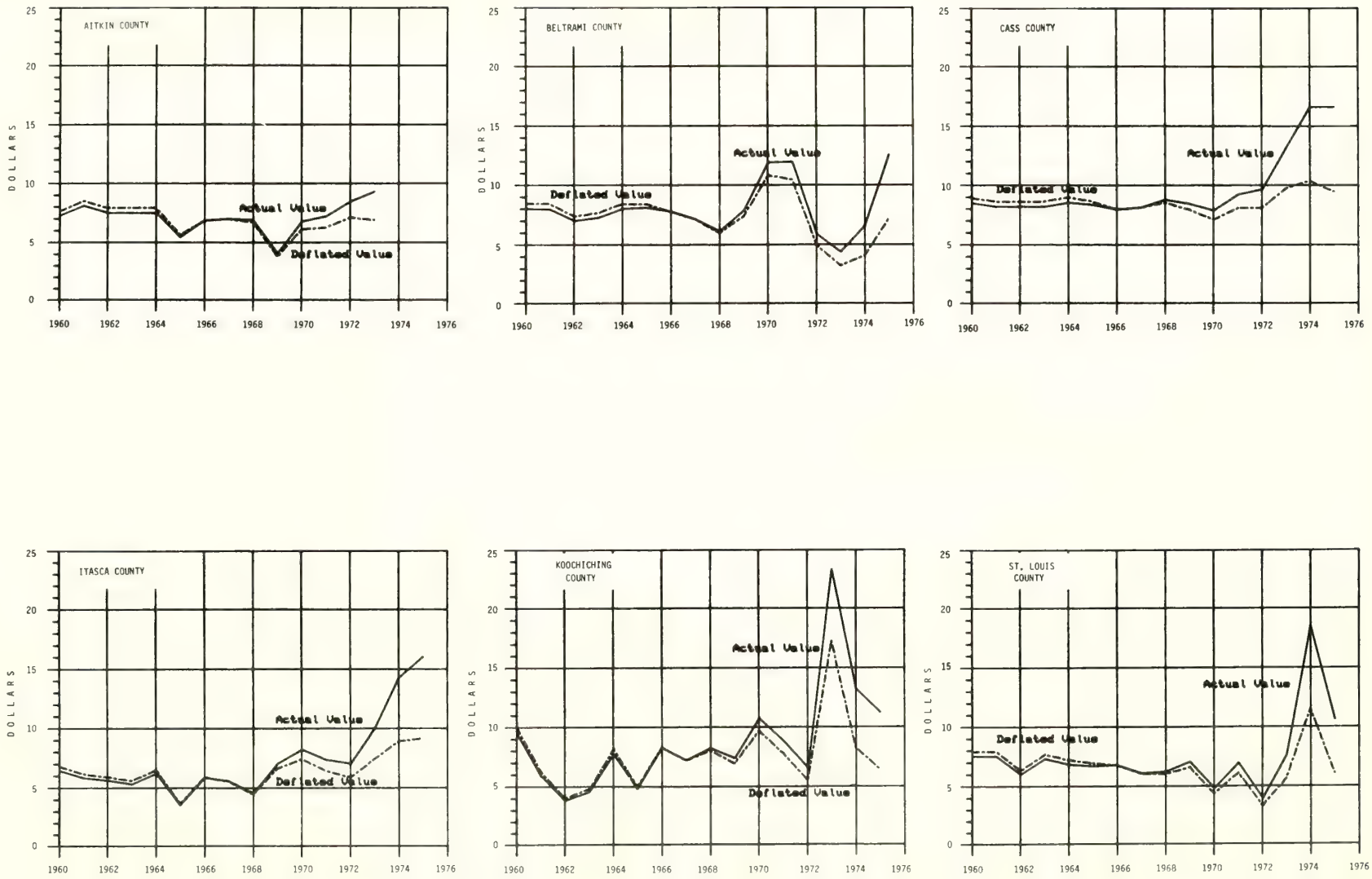


Figure 6.—*Average stumpage price per cord for red and white pine harvested in six northern Minnesota counties, 1960-1975. (Deflated value determined by wholesale price index (1967 = 100).)*

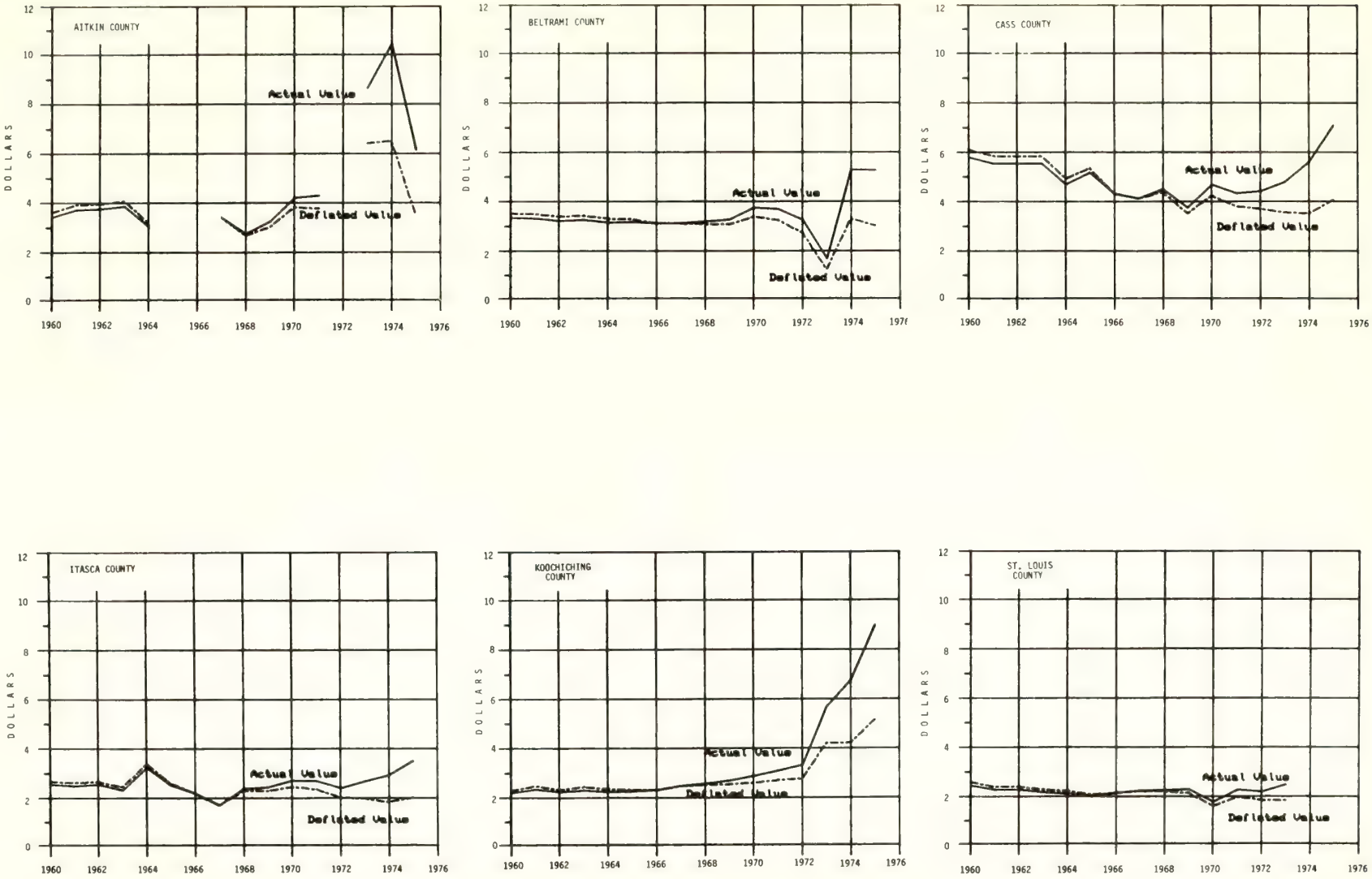


Figure 7.— *Average stumpage price per cord for jack pine harvested in six northern Minnesota counties, 1960-1975. (Deflated value determined by wholesale price index (1967 = 100).)*

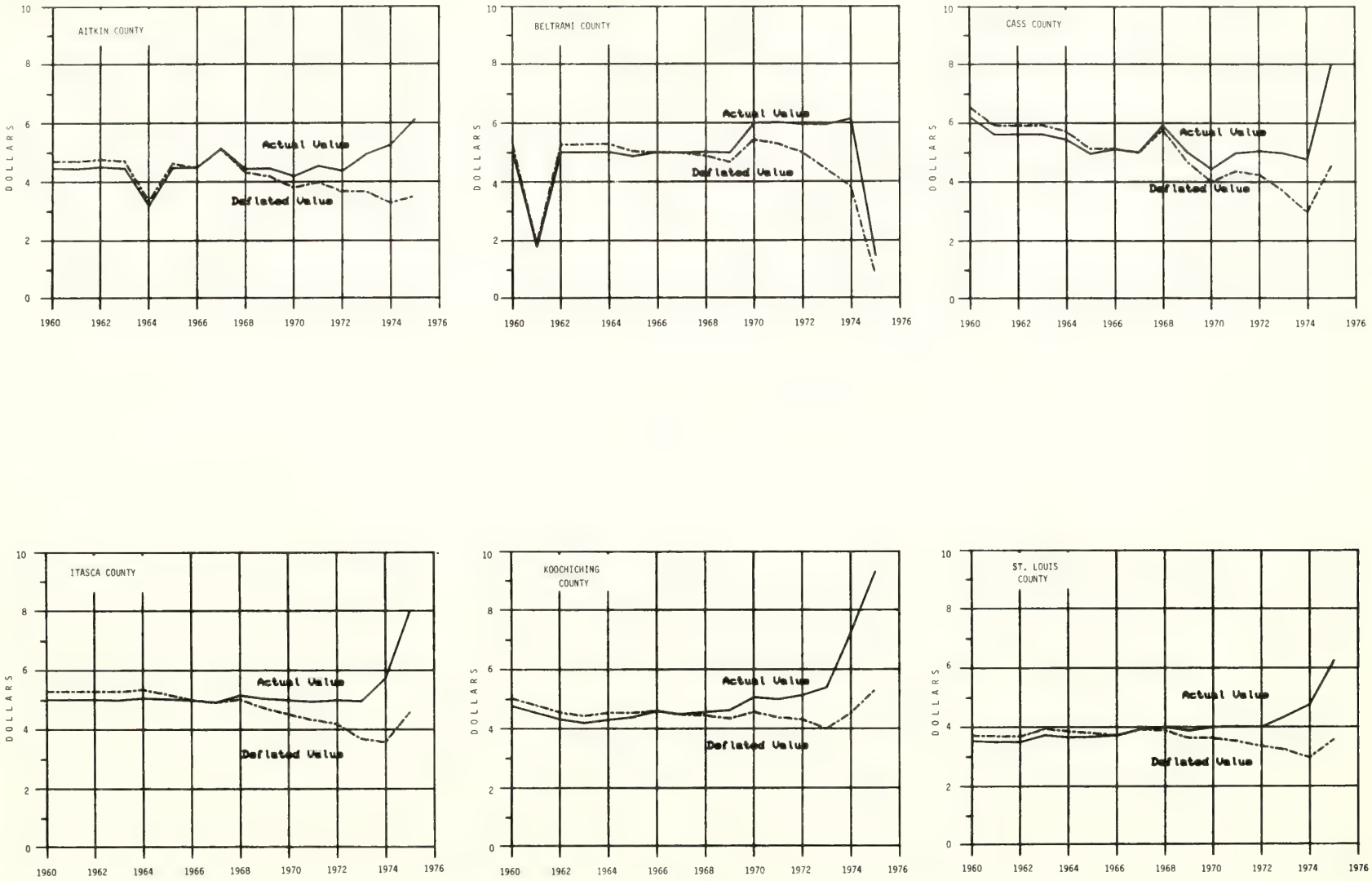


Figure 8.— *Average stumpage price per cord for spruce harvested in six northern Minnesota counties, 1960-1975. (Deflated value determined by wholesale price index (1967 = 100).)*

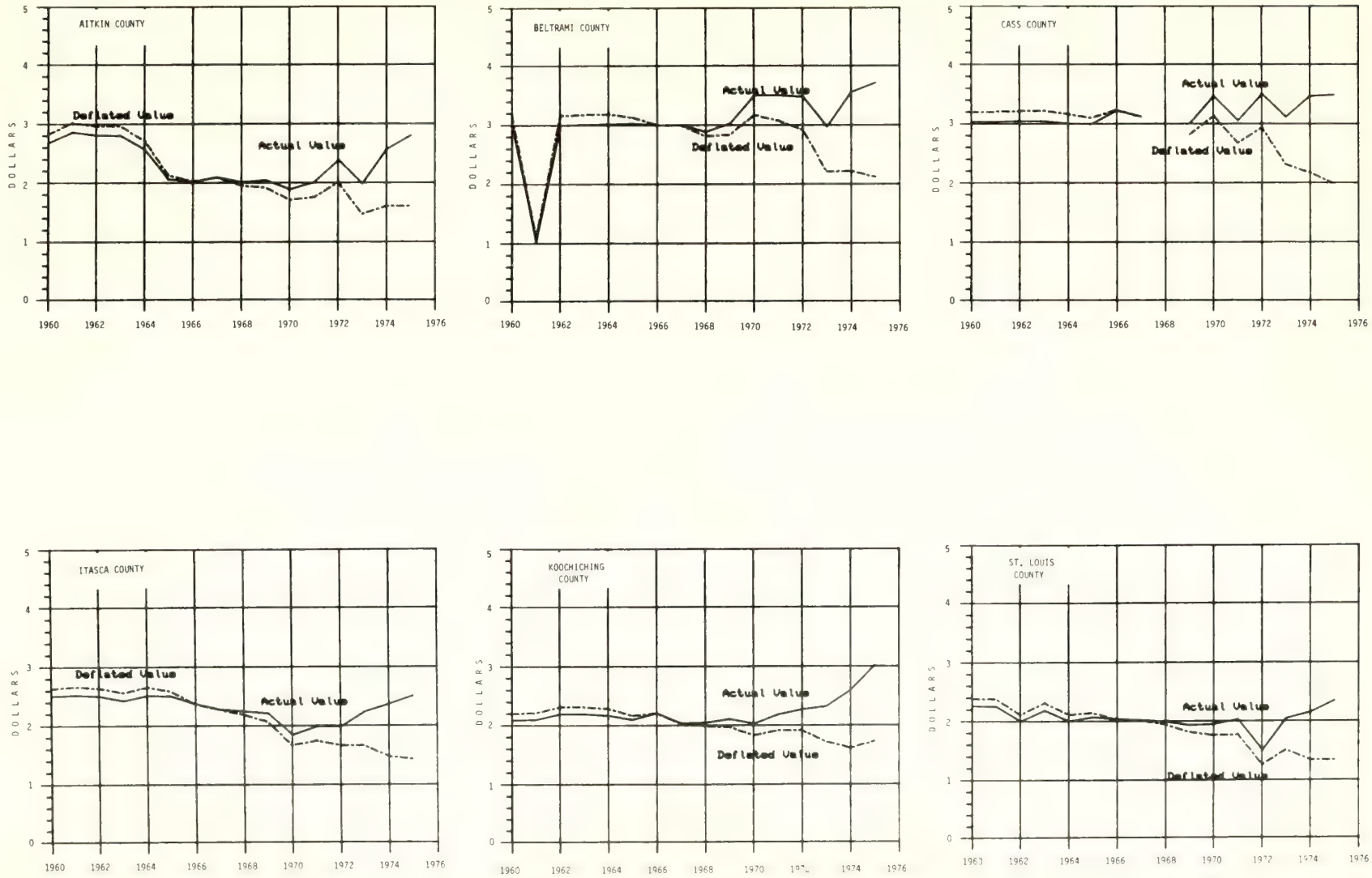


Figure 9.—*Average stumpage price per cord for balsam fir harvested in six northern Minnesota counties, 1960-1975. (Deflated value determined by wholesale price index (1967 = 100).)*

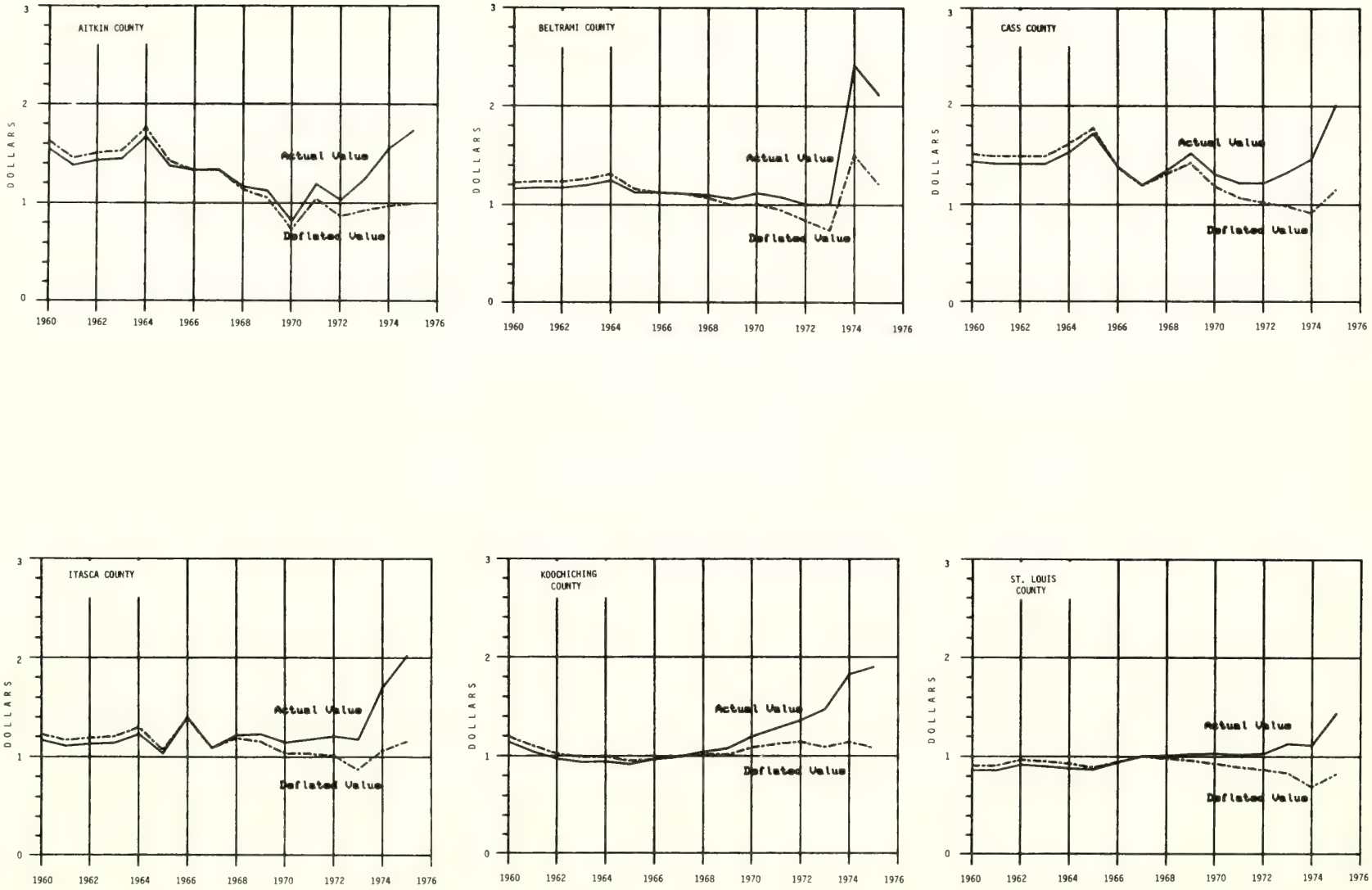


Figure 10.— *Average stumpage price per cord for aspen harvested in six northern Minnesota counties, 1960-1975. (Deflated value determined by wholesale price index (1967 = 100).)*

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-667213/10

Lothner, David C., Edwin Kallio, and David T. Davis.
1979. Minnesota's tax-forfeited land: some trends in timber harvested and stumpage prices. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-42, 12 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

The volume of timber harvested from Minnesota tax-forfeited land increased from about 145,000 cord equivalents in 1960 to 235,000 cord equivalents in 1975. Actual prices paid for stumpage decreased slightly in the 1960's and increased in the 1970's. However, in deflated dollars, stumpage prices decreased slightly throughout the period.

OXFORD: 652.51:922.2(776). KEY WORDS: Counties, northern Minnesota, timber utilization.

Lothner, David C., Edwin Kallio, and David T. Davis.
1979. Minnesota's tax-forfeited land: some trends in timber harvested and stumpage prices. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-42, 12 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

The volume of timber harvested from Minnesota tax-forfeited land increased from about 145,000 cord equivalents in 1960 to 235,000 cord equivalents in 1975. Actual prices paid for stumpage decreased slightly in the 1960's and increased in the 1970's. However, in deflated dollars, stumpage prices decreased slightly throughout the period.

OXFORD: 652.51:922.2(776). KEY WORDS: Counties, northern Minnesota, timber utilization.

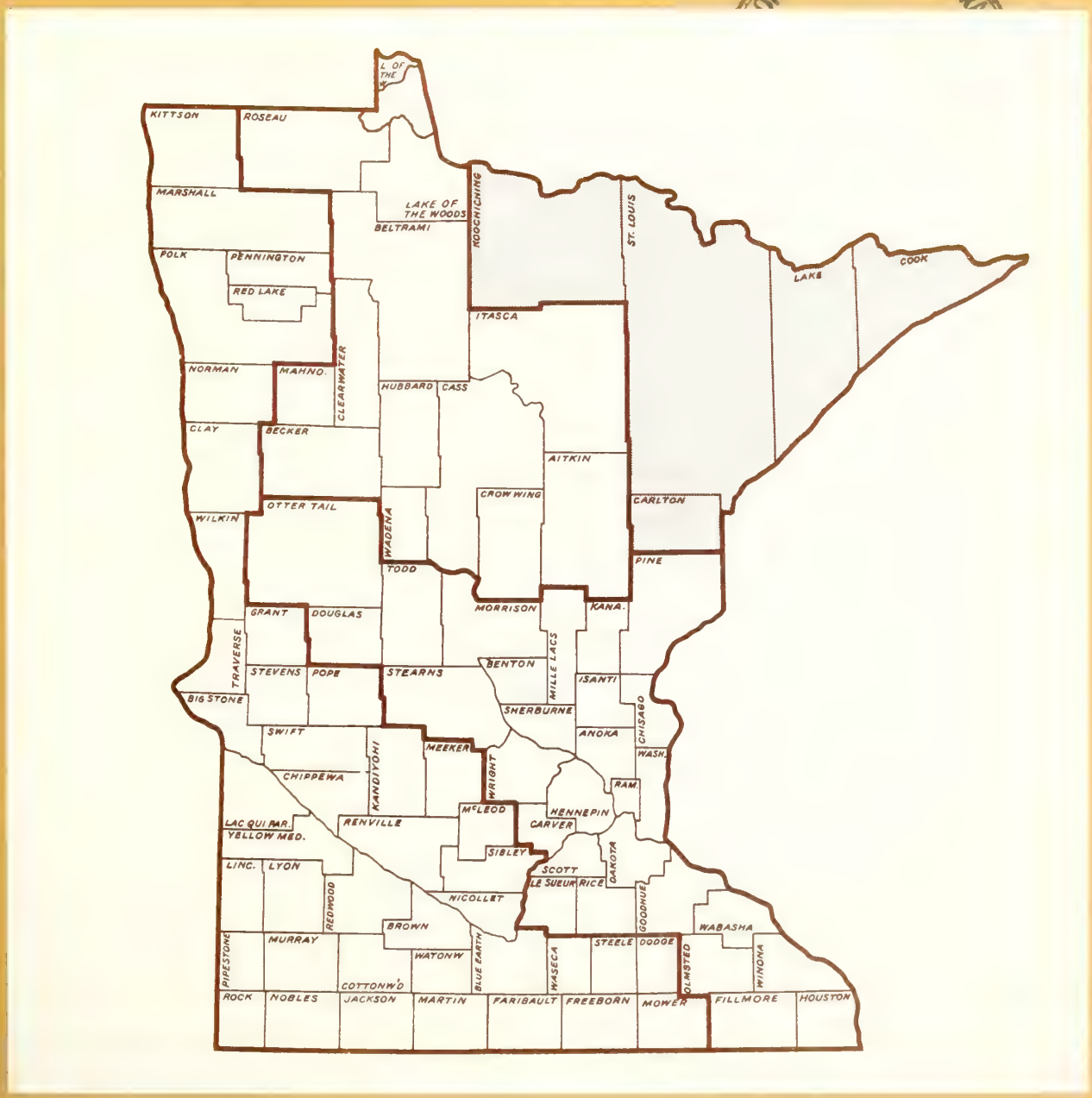
Put trash in the proper place.

USDA FOREST SERVICE
RESOURCE BULLETIN **NC-43**

Timber resource of Minnesota's aspen-birch unit, 1977.

John S. Spencer, Jr., and Arnold J. Ostrom

UNIVERSITY LIBR



North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication May 17, 1979
1979

FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceeded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

The 1977 Minnesota survey data have been adjusted to take into account expansion of the reserved portion of the Boundary Waters Canoe Area (BWCA). The Bill that increased the reserved portion of the BWCA was not passed by Congress until the fall of 1978. The adjustments were made so that the data are as current as possible.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Aspen-Birch Unit survey were furnished by the Superior National Forest, Minnesota Department of Natural Resources, Lake County Land Commissioner's Office, and Boise Cascade Company.

CONTENTS

	Page
Highlights	1
Tables	3
Principal Tree Species in Minnesota's Aspen-Birch Unit	4
Appendix	5
Accuracy of Survey	5
Survey Procedures	5
Comparing Minnesota's Fourth Forest Survey with the Third Survey	6
Metric Equivalents of Units Used in this Report	7
Definition of Terms	7

TIMBER RESOURCE OF MINNESOTA'S ASPEN-BIRCH UNIT, 1977

John S. Spencer, Jr., *Resource Analyst,*
and **Arnold J. Ostrom,** *Mensurationist*

HIGHLIGHTS

Forest Area

• Forest land occupies 7.5 million acres in 1977 (87 percent of the Unit's land area) as compared to 7.8 million acres (88 percent) in 1962.[1]

• Commercial forest land accounts for 5.5 million acres (73 percent of the total forest area), a decline of 13 percent from the 6.2 million acres in 1962 (80 percent of total forest area).

• The area of productive-reserved forest increased from 0.4 million acres in 1962 to 1.1 million acres (a 162 percent increase), due largely to the creation of Voyageurs National Park and to the addition of the Portal Zone (former commercial forest) to the completely reserved Boundary Waters Canoe Area on the Superior National Forest.

• St. Louis County contains the Unit's largest area of commercial forest (2.5 million acres) followed by Koochiching County (1.3 million), and Lake County (0.9 million).

• In terms of proportion of forest land to total land, Cook County is the most heavily forested (99 percent), and Carlton County is the least heavily forested (61 percent).

• Sixty-six percent (3.6 million acres) of the commercial forest land in the Unit is in public ownership (fig. 1); the Superior National Forest is the largest owner (1.2 million acres).

• The aspen forest type dominated the commercial forest in 1977 with 1.9 million acres (36 per-

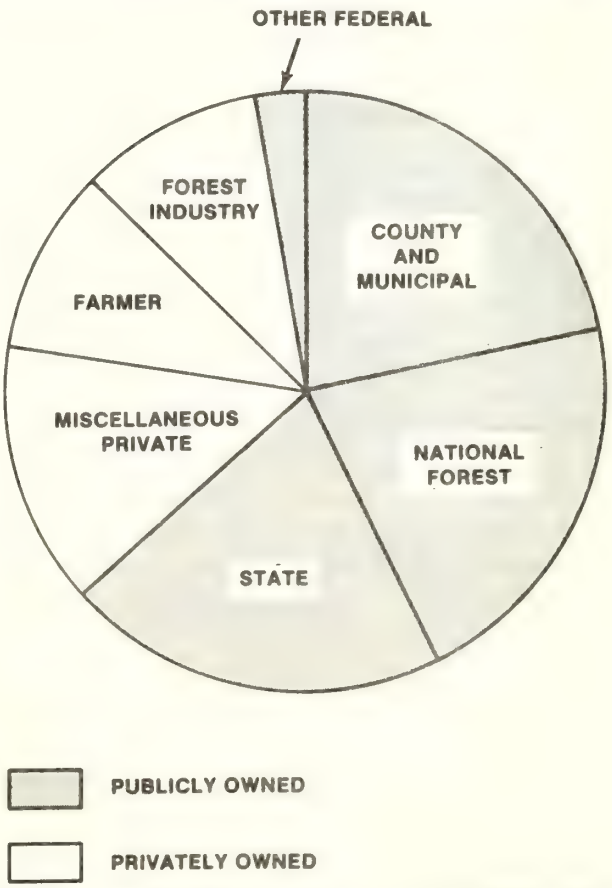


Figure 1.—*Distribution of commercial forest land by ownership class, Aspen-Birch Unit, Minnesota, 1977.*

[1]*1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix.)*

cent of the commercial forest). In 1962 the aspen type accounted for 2.1 million acres (33 percent).

• Poletimber stands constitute the largest stand-size class, 52 percent of the commercial forest area.

• Thirteen percent (1.0 million acres) of the Unit's forest land is classed as unproductive.

Timber volume

• Although commercial forest area declined between surveys, growing-stock volume increased from 4.2 billion cubic feet in 1962 to 4.5 billion cubic feet in 1977, a 6 percent gain (fig. 2).

• Sawtimber volume increased from 5.7 billion board feet in 1962 to 8.3 billion board feet in 1977 (a 45 percent increase).

• Forty-eight percent of the Unit's growing-stock volume is in St. Louis County (2.2 billion cubic feet).

• Aspen accounts for 1.4 billion cubic feet, 31 percent of the 1977 growing-stock volume. In 1962 aspen accounted for 1.2 billion cubic feet (29 percent).

• Twenty-seven percent of the Unit's growing-stock volume is on Superior National Forest land (1.2 billion cubic feet). County and municipal owners account for the next largest volume (0.9 billion cubic feet).

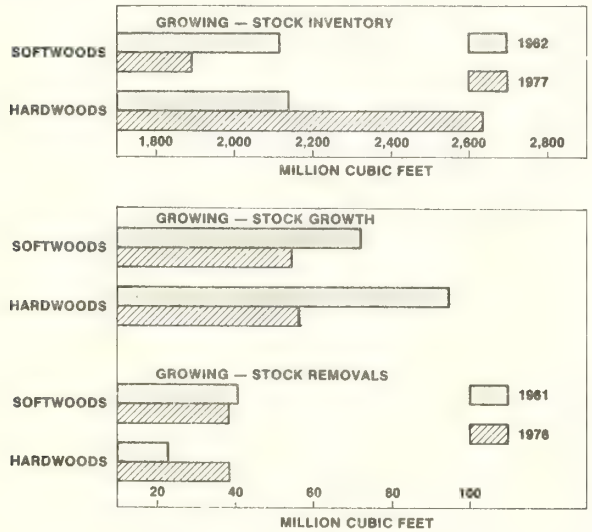


Figure 2.—*Growing-stock inventory, net annual growth, and removals, by softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1962 to 1977.*

• Forty-eight percent of the growing-stock volume is in stands aged 41 to 60 years.

• The average growing-stock volume per acre in 1977 is 830 cubic feet (10.5 cords per acre), compared to 680 cubic feet (8.6 cords per acre) in 1962, a 22 percent increase.

• The volume of cull trees (rough, rotten, and short-log cull) is 391 million cubic feet; salvable dead trees total 27 million cubic feet.

Stand Conditions

• Net annual growth on growing-stock trees was 115 million cubic feet (1.5 million cords) in 1976, compared with 163 million cubic feet (2.1 million cords) in 1961.

• Net annual growth rate of growing stock was 2.5 percent of inventory. The growth rate for softwoods (3.0 percent) was higher than that for hardwoods (2.2 percent).

• Net growth averaged 21.1 cubic feet per acre in 1976, compared with 26.1 in 1961.

• Average annual mortality of growing-stock trees was 55 million cubic feet in 1976; disease accounted for 59 percent of it.

• Mortality of growing-stock trees averaged 1.1 percent of inventory.

• Fifty-eight percent of the commercial forest area is capable of growing trees 50 feet and taller at age 50, but only 12 percent is capable of growing trees 70 feet and taller at the same age.

• Fifty-seven percent of the commercial forest is in stands 50 years of age or younger.

Timber Use

• Timber removals from growing stock totaled 77 million cubic feet (1.0 million cords) in 1976—39 million cubic feet of softwoods and 38 million of hardwoods.

• Growing-stock removals[2] in 1976 represented a 21 percent increase over removals in 1962 (64 million cubic feet).

---

[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commerical forest land to productive-reserved are not included in 1976 removals.*

- Forty-four percent of growing-stock removals came from St. Louis County (34 million cubic feet); 36 percent from Koochiching County (28 million cubic feet).
- Thirty-eight percent of the growing-stock removals came from private, nonindustrial lands.
- Timber products output totaled 79 million cubic feet in 1975; 64 million cubic feet of it in pulpwood alone.
- Primary plant residue totaled 3.6 million cubic feet in 1975, of which 1.0 million cubic feet were not utilized.

TABLES

Area:

1. Area of land by land class, 1962 and 1977.
2. Area of land by land class and county.
3. Area of commercial forest land by county and ownership class.
4. Area of commercial forest land by county and forest type.
5. Area of commercial forest land by county and site index class.
6. Area of commercial forest land by county and stand-size class.
7. Area of commercial forest land by site and ownership class.
8. Area of commercial forest land by forest type and ownership class.
9. Area of commercial forest land by forest type and stand-age class.
10. Area of commercial forest land by forest type, stand-size, and site class.
11. Area of noncommercial forest land by ownership class.
12. Area of noncommercial forest land by forest type.

Number of Trees:

13. Number of all live trees on commercial forest land by species and diameter class.
14. Number of growing-stock trees on commercial forest land by species and diameter class.
15. Number of short-log trees on commercial forest land by species and diameter class.

Volume:

16. Net volume of growing stock and sawtimber on commercial forest land by species, 1962 and 1977.
17. Cubic foot volume in all live trees on commercial forest land by species and diameter class.
18. Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods.
19. Net volume of growing stock on commercial forest land by species and county.
20. Net volume of sawtimber on commercial forest land by species and county.
21. Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species.
22. Net volume of growing stock on commercial forest land, by species and diameter class.
23. Net volume of sawtimber on commercial forest land by species and diameter class.
24. Net volume of growing stock on commercial forest land by species and forest type.
25. Net volume of sawtimber on commercial forest land by species and forest type.
26. Net volume of growing stock on commercial forest land by species and ownership class.
27. Net volume of sawtimber on commercial forest land by species and ownership class.
28. Net volume of growing stock on commercial forest land by forest type and stand-age class.
29. Net volume of sawtimber on commercial forest land by forest type and stand-age class.
30. Net volume of short-log trees on commercial forest land, by species and diameter class (in cubic feet).
31. Net volume of short-log trees on commercial forest land by species and diameter class (in board feet).

Growth:

32. Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, 1961 and 1976.

33. Net annual growth of growing stock on commercial forest land by species and county.
34. Net annual growth of sawtimber on commercial forest land by species and county.
35. Net annual growth of growing stock on commercial forest land by species and ownership class.
36. Net annual growth of sawtimber on commercial forest land by species and ownership class.
37. Net annual growth of growing stock on commercial forest land by species and forest type.
38. Net annual growth of sawtimber on commercial forest land by species and forest type.
39. Net annual growth of growing stock on commercial forest land by forest type and stand-age.
40. Net annual growth of sawtimber on commercial forest land by forest type and stand-age.

Timber Removals:

41. Timber removals from growing stock and sawtimber on commercial forest land by species, 1962 and 1976.
42. Timber removals from growing stock on commercial forest land by species and county.
43. Timber removals from sawtimber on commercial forest land by species and county.
44. Timber removals from growing stock and sawtimber on commercial forest land by item and species group.
45. Timber removals from growing stock by ownership class and softwoods and hardwoods.
46. Timber removals from sawtimber by ownership class and softwoods and hardwoods.

Mortality:

47. Annual mortality of growing stock on commercial forest land by species and cause.
48. Annual mortality of sawtimber on commercial forest land by species and cause.
49. Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods.

Utilization:

50. Output of timber products by source of material and softwoods and hardwoods.
51. Forest products harvested by ownership class and product.
52. Volume of primary plant residue by kind of material and type of use.
53. Timber products output from roundwood by species and product.

Text Table:

54. Sampling errors for estimates smaller than Unit totals of volume, net growth, removals, and area of commercial forest land.

PRINCIPAL TREE SPECIES IN MINNESOTA'S ASPEN-BIRCH UNIT[3]

SOFTWOOD SPECIES

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*
Other softwoods:
  Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES

White oaks
  White oak ..... *Quercus alba*
  Bur oak ..... *Quercus macrocarpa*
Select red oaks
  Northern red oak ..... *Quercus rubra*
Yellow birch ..... *Betula alleghaniensis*
Hard maples
  Black maple ..... *Acer nigrum*
  Sugar maple ..... *Acer saccharum*

[3]*The common and scientific names are based on: Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

Soft maples
- Red maple ..... *Acer rubrum*
- Silver maple ..... *Acer saccharinum*

Ashes
- Black ash ..... *Fraxinus nigra*
- Green ash ..... *Fraxinus pennsylvanica*

Balsam poplar ..... *Populus balsamifera*
Paper birch ..... *Betula papyrifera*
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Basswood ..... *Tilia americana*

Elms
- American elm ..... *Ulmus americana*
- Slippery elm ..... *Ulmus rubra*
- Rock elm ..... *Ulmus thomasii*

Select hardwoods
- Black cherry ..... *Prunus serotina*

Other hardwoods
- Boxelder ..... *Acer negundo*
- Eastern cottonwood ..... *Populus deltoides*
- Black willow ..... *Salix nigra*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Aspen-Birch Unit in 1977, 5,451.4 thousand acres, has a sampling error of ±0.32 percent (±17.4 thousand acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would fall between 5,468.8 and 5,434.0 thousand acres (5,451.4 ±17.4).

Sampling errors were calculated separately for National Forest land and other land, reflecting the higher sampling intensity on other land. For example, the sampling error for growing-stock inventory on National Forest land is ±6.20 percent, but on other land it is ±1.39 percent.

The following sampling errors are a combination of National Forest and other land sampling errors for total estimated volume, net growth, and removals for both growing stock and sawtimber, and for area of commercial forest land during the 1977 Aspen-Birch Unit survey:

Item	Aspen-Birch Unit totals	Sampling error (percent)
Growing stock:		
Volume	4,522.1 MM cubic feet	1.97
Growth	114.9 MM cubic feet	3.05
Removals	77.2 MM cubic feet	4.56
Sawtimber:		
Volume	8,324.6 MM board feet	3.52
Growth	378.1 MM board feet	4.04
Removals	178.0 MM board feet	3.60
Commercial forest land:	5,451.4 M acres	0.32

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURES

The major steps in the survey of the Aspen-Birch Unit were as follows:

1. A total of 36,109 1-acre points distributed systematically across aerial photos of the entire area, except the Superior National Forest, were observed. To make a preliminary estimate of forest area these points were classified as either forest land (25,086), unproductive forest land (2,213), nonforest land (7,647), or questionable (1,163). Next, all 25,086 of the forest points, 289 of the unproductive forest points, and all 1,163 questionable points were stereoclassified as to forest type, stand-size class, and density. Then 3,420 points classed as forest, 289 points classed as unproductive, and 157 points classed as questionable were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 3,093 commercial forest locations, 10-point variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Area statistics for the Superior National Forest were prepared by the Forest Timber Management staff from compartment examination records. Volume data for Superior National Forest lands were prepared by Forest Timber Management staff using permanent sample plots established by Forest personnel. Superior National Forest data, then, were added to data for the rest of the State computed from 10-point variable-radius plot information.

3. Growth, mortality, and cull increment on all commercial forest land except the Superior National Forest were estimated using the Forest Resources Evaluation Program (FREP)[4], which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

4. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of all public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

5. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

6. Field data were sent to St. Paul, Minnesota, for editing and compilation.

COMPARING MINNESOTA'S FOURTH FOREST SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

In Minnesota's Aspen-Birch Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys. Then, a portion of the 1962 commercial forest area was withdrawn and added to unproductive forest (noncommercial) and to nonforest to allow for changes in the method of determining these land uses. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area.

[4]*For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. NC-49, 96 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

However, because the 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes. Volume adjustments were made by estimating inventory, growth, mortality, and removals on the unproductive forest and nonforest lands originally classed as commercial forest in 1962, and subtracting these volumes from the original State 1962 estimates.

A test was made to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so the changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commercial forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys reflected actual change and not merely a change in the volume equations used on each occasion.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals, and are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included. Previously published 1962 estimates are of timber cut only, and do not include "other" removals. TRAS generated an estimate of what "other" removals must have been in 1962 to provide the adjusted 1962 total removals.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.

1,000 acres = 405 hectares.

1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.

Breast height = 1.4 meters above the ground.

1 cubic foot = 0.0283 cubic meter.

1 foot = 30.48 centimeters or 0.3048 meter.

1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than 1/8-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased.—Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.—Land owned by a private individual but leased to another party.

Tree Classes

All live trees.—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.—Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more

han 6 inches and hardwood seedlings more than 1 oot tall are counted.

Rotten trees.—Live trees (any size) of commerial species that do not contain a merchantable 12-oot saw log or two noncontiguous 8-foot or longer aw logs, now or prospectively, because of rot (that s, when more than 50 percent of the cull volume of he tree is rotten).

Rough trees.—Live trees that do not contain at east one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as vell as all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized rees of commercial species that contain at least ne merchantable 8- to 11-foot saw log but not a 2-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of rees in a stand compared to the basal area and/or umber of trees required to fully utilized the rowth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of asal area per acre in trees 5 inches d.b.h. and arger. In a stand of trees less than 5 inches d.b.h., stocking percent of 100 would indicate that the resent number of trees is sufficient to produce 80 quare feet of basal area per acre when the trees each 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, nd desirable trees are recorded separately and tands are grouped into the following stocking lasses.

Stocking Classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.—Stands in which tocking of trees is from 100 to 133 percent.

Medium-stocked stands.—Stands in which tocking of trees is from 60 to 100 percent.

Poorly-stocked stands.—Stands in which tocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-size Classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of live-tree stocking, with black spruce the most common.

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of live-tree stocking, with northern white-cedar the most common.

Tamarack.—Forests in which swamp conifers comprise a plurality of live-tree stocking, with tamarack the most common.

Oak.—Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.—Net volume of the saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.—That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.—Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year.

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

the annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year, and

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Mortality of growing stock.—The volume of sound wood in growing-stock trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber.—The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.—Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Aspen-Birch Unit, Minnesota, 1962*[1] *and 1977*
(In thousand acres)

Land class	1962	1977
Commercial forest land:		
Jack pine	395.6	165.7
Red pine	117.0	114.4
White pine	85.2	33.8
Balsam fir	669.2	626.0
White spruce	48.8	60.1
Black spruce	824.7	745.7
Northern white-cedar	206.5	317.8
Tamarack	151.9	157.6
Oak	2.3	5.4
Elm-ash-cottonwood	224.6	243.7
Maple-basswood	161.4	214.5
Aspen	2,070.8	1,947.4
Paper birch	496.5	546.3
Balsam poplar	207.2	208.0
Nonstocked	582.3	65.0
Subtotal	6,244.0	5,451.4
Noncommercial forest land:		
Unproductive	1,125.4	969.8
Productive-reserved	400.9	1,050.6
Subtotal	1,526.3	2,020.4
Nonforest land:	1,064.9	1,161.6
Total	8,835.2	8,633.4

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Land class	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Forest land:						
Commercial	5,451.4	312.8	538.8	1,278.9	855.3	2,465.6
Productive-reserved	1,050.6	11.1	292.5	12.9	313.0	421.1
Unproductive	969.8	12.2	21.6	502.5	88.8	344.7
Total forest	7,471.8	336.1	852.9	1,794.3	1,257.1	3,231.4
Nonforest land:						
Nonforest with trees:						
Improved pasture with trees	4.8	—	—	1.7	—	3.1
Wooded strips	10.6	2.8	—	1.3	—	6.5
Idle farmland with trees	1.6	—	—	—	—	1.6
Windbreaks	13.5	2.8	—	2.4	—	8.3
Wooded pasture	23.3	4.4	—	2.8	—	16.1
Total nonforest with trees	53.8	10.0	—	8.2	—	35.6
Nonforest without trees:						
Cropland without trees	357.1	92.4	.5	80.3	3.4	180.5
Improved pasture without trees	67.6	11.1	.5	19.5	5.4	31.1
Idle farmland without trees	15.4	2.8	—	2.8	—	9.8
Marsh	350.6	58.6	3.9	62.3	34.4	191.4
Other	33.6	12.6	.9	7.0	1.9	11.2
Urban and other	283.5	28.2	2.7	26.9	17.6	208.1
Total nonforest without trees	1,107.8	205.7	8.5	198.8	62.7	632.1
Total nonforest	1,161.6	215.7	8.5	207.0	62.7	667.7
Total land area[1]	8,633.4	551.8	861.4	2,001.3	1,319.8	3,899.1
Census water	715.1	7.6	129.3	29.4	152.8	396.0
Total gross area	9,348.5	559.4	990.7	2,030.7	1,472.6	4,295.1

[1]U.S. Department of Commerce, Bureau of Census. Area Measurement Reports, GE-20 No. 1, 22p., 1970.

Table 3.—*Area of commercial forest land by county and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

	Ownership class													
County	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Carlton	312.8	—	—	6.9	—	45.7	56.5	27.1	121.6	—	5.8	49.2	—	—
Cook	538.8	335.9	—	31.7	2.6	71.4	6.5	37.7	5.2	—	9.6	38.2	—	—
Koochiching	1,278.9	—	2.6	40.7	—	597.3	273.2	227.6	85.1	—	8.0	42.0	1.4	1.0
Lake	855.3	370.6	—	—	8.6	98.2	143.3	97.5	15.5	—	46.5	75.1	—	—
St. Louis	2,465.6	446.3	5.5	18.2	9.5	319.5	706.4	144.8	316.8	—	176.9	319.1	2.6	—
All counties	5,451.4	1,152.8	8.1	97.5	20.7	1,132.1	1,185.9	534.7	544.2	—	246.8	523.6	4.0	1.0

Table 4.—*Area of commercial forest land by county and forest type, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Forest type	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Jack pine	165.7	1.4	17.1	17.8	40.8	88.6
Red pine	114.4	4.1	—	13.2	45.9	51.2
White pine	33.8	—	3.9	—	4.8	25.1
Balsam fir	626.0	12.7	108.9	101.6	151.9	250.9
White spruce	60.1	1.4	19.7	11.3	12.3	15.4
Black spruce	745.7	19.8	56.5	279.1	99.7	290.6
Northern white-cedar	317.8	2.7	31.6	159.3	46.6	77.6
Tamarack	157.6	16.2	—	74.2	2.7	64.5
Oak	5.4	4.0	—	—	—	1.4
Elm-ash-cottonwood	243.7	37.5	8.0	88.1	26.3	83.8
Maple-basswood	214.5	21.9	39.8	16.7	63.3	72.8
Aspen	1,947.4	142.1	164.0	377.6	188.4	1,075.3
Paper birch	546.3	28.2	85.3	31.5	150.3	251.0
Balsam poplar	208.0	17.1	—	95.7	14.1	81.1
Nonstocked	65.0	3.7	4.0	12.8	8.2	36.3
All types	5,451.4	312.8	538.8	1,278.9	855.3	2,465.6

Table 5.—*Area of commercial forest land by county and site-index class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

		Site index class								
County	All classes	91	81-90	71-80	61-70	51-60	41-50	31-40	21-30	11-20
Carlton	312.8	1.4	9.8	39.2	87.7	77.8	55.7	23.2	16.6	1.4
Cook	538.8	—	2.7	24.9	89.1	161.3	158.3	52.2	48.5	1.8
Koochiching	1,278.9	7.1	56.5	109.4	188.2	209.4	210.7	223.3	232.8	41.5
Lake	855.3	1.4	5.0	57.7	143.2	291.3	195.7	89.6	66.1	5.3
St. Louis	2,465.6	15.5	68.1	251.1	582.4	658.3	476.0	256.6	132.8	24.8
All counties	5,451.4	25.4	142.1	482.3	1,090.6	1398.1	1,096.4	644.9	496.8	74.8

Table 6.—*Area of commercial forest land by county and stand-size class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

		Stand-size class			
County	All classes	Sawtimber	Poletimber	Restocking	Nonstocked
Carlton	312.8	38.4	162.2	108.5	3.7
Cook	538.8	142.5	295.9	96.4	4.0
Koochiching	1,278.9	193.7	589.2	483.2	12.8
Lake	855.3	194.8	429.9	222.4	8.2
St. Louis	2,465.6	373.5	1,369.9	685.9	36.3
All counties	5,451. 4	942.9	2,847.1	1,596.4	65.0

Table 7.—*Area of commercial forest land by site and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year) 225+	165-225	120-165	85-120	50-85	20-50
National forest	1,152.8	—	—	—	14.8	519.3	618.7
Bureau of land mgmt.	8.1	—	—	—	1.4	1.4	5.3
Indian	97.5	—	—	2.8	16.5	29.9	48.3
Miscellaneous Federal	20.7	—	—	—	3.1	9.3	8.3
State	1,132.1	—	1.4	18.1	143.0	245.4	724.2
County and municipal	1,185.9	—	1.3	27.9	206.0	423.6	527.1
Forest industry	534.7	—	—	13.6	90.1	163.4	267.6
Farmer	544.2	—	—	5.4	87.4	207.2	244.2
Farmer-owned, leased	—	—	—	—	—	—	—
Misc. private-corp.	246.8	—	—	2.6	38.0	109.3	96.9
Misc. private-individual	523.6	—	—	10.3	82.3	210.7	220.3
Misc. priv.-corp., leased	4.0	—	—	—	1.4	2.6	—
Misc. priv.-ind., leased	1.0	—	—	—	1.0	—	—
All owners	5,451.4	—	2.7	80.7	685.0	1,922.1	2,760.9

Table 8.—*Area of commercial forest land by forest type and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	Forest type All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash-cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
National forest	1,152.8	88.9	73.3	15.0	145.2	24.0	153.0	48 8	—	—	5.8	39 8	391.6	147.2	—	20.2
Bureau of land mgmt.	8.1	—	—	1.4	—	—	3.9	1.4	—	—	—	—	1.4	—	—	—
Indian	97.5	—	2.5	—	14.5	2.4	13.3	11.5	—	—	7.3	2.7	31.0	12.3	—	—
Miscellaneous Federal	20.7	2.9	—	—	2.9	—	2 6	—	—	-	—	1 4	8.1	2.8	—	—
State	1,132.1	29 3	8.5	1.4	133.5	18.2	293.0	126.9	89 9	—	44.3	18 8	257.1	60.6	44.1	6.5
County and municipal	1,185.9	20.5	12.1	3.0	142.6	—	123.6	48.5	29 4	—	71.0	59.7	471.0	125.3	58.8	20.4
Forest industry	534.7	11 4	4.4	5.1	72.1	2.7	60 1	48.4	7.3	1.4	25.5	20 5	210.7	40.1	20.5	4.5
Farmer	544.2	3.1	2.6	2.7	37.7	4.7	40 6	8.3	19.7	2 6	44 4	31.6	255.4	48.3	38.5	4.0
Farmer-owned, leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private-corp.	246.8	5.3	2.8	1.0	31.1	—	23.3	6.6	4.8	—	8.2	8.3	98.9	41.9	10.7	3.9
Misc. private-individual	523 6	4.3	8.2	4.2	46.4	8.1	32.3	17.4	6.5	1.4	37.2	31.7	217.2	67.8	35.4	5.5
Misc. priv.-corp., leased	4.0	—	—	—	—	—	—	—	—	—	—	—	4 0	—	—	—
Misc. priv.-ind., leased	1.0	—	—	—	—	—	—	—	—	—	—	—	1.0	—	—	—
All owners	5,451.4	165.7	114.4	33.8	626.0	60.1	745.7	317.8	157.6	5.4	243 7	214.5	1,947.4	546.3	208.0	65.0

Table 9.—*Area of commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All ages	Stand-age class(years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	165.7	13.5	1.4	26.3	15.9	28.3	31.3	23.0	1.5	12.2	9.6	2.7	—	—
Red pine	114.4	1.6	33.5	1.1	22.8	9.5	11.5	5.3	8.0	18.6	1.2	1.3	—	—
White pine	33.8	2.1	1.4	—	—	2.1	—	3.8	5.6	2.5	15.0	1.3	—	—
Balsam fir	626.0	30.4	44.4	51.7	83.8	175.4	142.7	51.4	26.2	9.6	9.1	1.3	—	—
White spruce	60.1	12.8	6.1	1.4	8.2	18.8	5.2	1.3	1.2	1.3	2.7	1.1	—	—
Black spruce	745.7	26.9	72.3	112.5	105.6	93.7	96.1	51.6	70.2	39.3	55.2	12.7	9.6	—
Northern white-cedar	317.8	1.4	7.6	16.6	17.6	13.8	22.7	32.3	36.1	39.0	57.1	29.5	44.1	—
Tamarack	157.6	12.5	34.5	21.7	14.1	15.1	14.6	11.9	8.4	6.7	1.4	10.5	5.0	1.2
Oak	5.4	—	—	—	1.2	2.8	1.4	—	—	—	—	—	—	—
Elm-ash-cottonwood	243.7	20.5	20.7	10.0	12.8	29.4	37.4	27.9	18.1	25.8	19.1	12.5	9.5	—
Maple-basswood	214.5	4.0	12.4	6.7	13.9	38.6	40.3	13.8	17.6	11.9	31.4	14.8	9.1	—
Aspen	1,947.4	244.7	177.6	199.6	286.3	409.0	383.2	150.8	60.8	25.7	8.3	1.4	—	—
Paper birch	546.3	25.3	41.1	17.9	56.5	138.4	122.1	59.5	49.7	27.0	7.4	1.4	—	—
Balsam poplar	208.0	21.8	18.1	11.6	34.8	52.7	35.5	15.4	12.5	4.2	1.4	—	—	—
Nonstocked	65.0	65.0	—	—	—	—	—	—	—	—	—	—	—	—
All types	5,451.4	482.5	471.1	477.1	673.5	1,027.6	944.0	448.0	315.9	223.8	218.9	90.5	77.3	1.2

Table 10.—*Area of commercial forest land by forest type, stand-size class, and site class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class 165 or more	120-165	85-120	50-85	Less than 50
Jack pine						
Sawtimber	68.3	—	—	—	23.7	44.6
Poletimber	66.3	—	—	1.4	12.3	52.6
Sapling & seedling	31.1	—	—	—	24.5	6.6
All stands	165.7	—	—	1.4	60.5	103.8
Red pine						
Sawtimber	49.2	—	1.4	6.0	25.8	16.0
Poletimber	19.9	—	—	3.8	6.3	9.8
Sapling & seedling	45.3	—	—	—	24.9	20.4
All stands	114.4	—	1.4	9.8	57.0	46.2
White pine						
Sawtimber	32.4	—	1.4	5.8	12.3	12.9
Poletimber	—	—	—	—	—	—
Sapling & seedling	1.4	—	—	1.4	—	—
All stands	33.8	—	1.4	7.2	12.3	12.9
Balsam fir						
Sawtimber	106.1	2.7	14.9	43.2	20.5	24.8
Poletimber	362.9	—	26.8	126.4	100.3	109.4
Sapling & seedling	157.0	—	12.2	38.2	45.0	61.6
All stands	626.0	2.7	53.9	207.8	165.8	195.8
White spruce						
Sawtimber	13.0	—	—	2.7	5.1	5.2
Poletimber	17.1	—	—	1.7	12.2	3.2
Sapling & seedling	30.0	—	—	5.9	12.9	11.2
All stands	60.1	—	—	10.3	30.2	19.6

(Continued on next page)

Table 10, continued

Forest type and stand-size class	Site class					
	All site classes	165 or more	120-165	85-120	50-85	Less than 50
Black spruce						
Sawtimber	24.0	—	—	—	2.6	21.4
Poletimber	304.4	—	—	5.3	18.7	280.4
Sapling & seedling	417.3	—	—	1.3	7.9	408.1
All stands	745.7	—	—	6.6	29.2	709.9
Northern white-cedar						
Sawtimber	110.2	—	—	—	2.8	107.4
Poletimber	153.0	—	—	—	10.7	142.3
Sapling & seedling	54.6	—	—	—	—	54.6
All stands	317.8	—	—	—	13.5	304.3
Tamarack						
Sawtimber	9.8	—	—	—	1.6	8.2
Poletimber	53.6	—	—	—	11.1	42.5
Sapling & seedling	94.2	—	—	—	7.0	87.2
All stands	157.6	—	—	—	19.7	137.9
Oak						
Sawtimber	—	—	—	—	—	—
Poletimber	5.4	—	—	1.4	1.4	2.6
Sapling & seedling	—	—	—	—	—	—
All stands	5.4	—	—	1.4	1.4	2.6
Elm-ash-cottonwood						
Sawtimber	45.0	—	—	—	—	45.0
Poletimber	138.8	—	—	—	4.1	134.7
Sapling & seedling	59.9	—	—	—	1.4	58.5
All stands	243.7	—	—	—	5.5	238.2
Maple-basswood						
Sawtimber	106.0	—	—	1.0	32.4	72.6
Poletimber	79.8	—	—	—	9.7	70.1
Sapling & seedling	28.7	—	—	—	7.1	21.6
All stands	214.5	—	—	1.0	49.2	164.3
Aspen						
Sawtimber	260.5	—	8.6	55.8	173.2	22.9
Poletimber	1,120.5	—	9.8	284.5	643.0	183.2
Sapling & seedling	566.4	—	4.2	61.6	346.9	153.7
All stands	1,947.4	—	22.6	401.9	1,163.1	359.8
Paper birch						
Sawtimber	69.4	—	—	1.5	22.2	45.7
Poletimber	419.2	—	—	—	144.3	274.9
Sapling & seedling	57.7	—	—	—	10.9	46.8
All stands	546.3	—	—	1.5	177.4	367.4
Balsam poplar						
Sawtimber	49.0	—	—	12.2	28.2	8.6
Poletimber	106.2	—	1.4	14.1	63.9	26.8
Sapling & seedling	52.8	—	—	5.5	31.0	16.3
All stands	208.0	—	1.4	31.8	123.1	51.7
Nonstocked	65.0	—	—	4.3	14.2	46.5
All types	5,451.4	2.7	80.7	685.0	1,922.1	2,760.9

Table 11.—*Area of noncommercial forest land by ownership class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National forest	856.1	756.8	99.3
Other federal	175.6	121.6	54.0
State, county and municipal	872.8	165.7	707.1
Forest industry	30.9	—	30.9
Farmer	55.3	—	55.3
Miscellaneous private	29.7	6.5	23.2
All ownerships	2,020.4	1,050.6	969.8

Table 12.—*Area of noncommercial forest land by forest type, Aspen-Birch Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Jack pine	203.2	202.0	1.2
Red-white pine	65.0	59.2	5.8
Spruce-fir	149.6	100.2	49.4
Black spruce	709.2	62.9	646.3
Northern white-cedar	104.8	12.4	92.4
Tamarack	104.2	3.0	101.2
Oak	2.7	.2	2.5
Elm-ash-cottonwood	44.9	8.9	36.0
Maple-basswood	13.8	9.5	4.3
Aspen-birch	609.1	589.7	19.4
Nonstocked	13.9	2.6	11.3
All forest types	2,020.4	1,050.6	969.8

Table 13.—*Number of all live trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	14,118	2,846	4,286	1,841	1,169	1,292	826	623	487	337	161	110	114	26	—
Red pine	33,273	13,881	4,622	5,124	3,817	2,687	1,514	841	371	178	170	54	14	—	—
Jack pine	39,027	2,479	5,939	10,367	9,793	6,079	3,079	864	378	33	14	—	2	—	—
White spruce	39,294	14,763	7,702	7,502	3,897	2,360	1,440	797	481	202	98	38	14	—	—
Black spruce	596,244	259,233	213,559	90,698	25,028	6,360	1,007	283	51	18	5	2	—	—	—
Balsam fir	760,272	390,303	213,303	101,516	38,356	12,739	3,185	755	95	15	5	—	—	—	—
Tamarack	95,761	38,546	34,407	15,072	5,590	1,366	628	116	27	9	—	—	—	—	—
Northern white-cedar	193,278	64,424	53,821	35,290	20,153	10,116	5,388	2,420	942	455	183	50	34	2	—
Other softwoods	455	135	270	30	15	—	—	5	—	—	—	—	—	—	—
Total softwoods	1,771,722	786,610	537,909	267,440	107,818	42,999	17,067	6,704	2,832	1,247	636	254	178	28	—
Hardwoods:															
Select white oaks	3,000	1,245	770	480	230	120	97	15	25	6	3	2	6	1	—
Select red oaks	2,540	538	269	716	360	318	182	96	42	12	7	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	2,894	712	705	267	334	209	249	144	70	85	31	38	44	6	—
Hard maple	93,280	51,407	24,008	10,076	3,666	2,091	809	502	387	204	64	36	30	—	—
Soft maple	125,966	67,422	37,030	14,273	4,902	1,330	653	222	72	53	7	2	—	—	—
Ash	217,082	120,577	50,127	26,362	11,185	5,660	1,808	879	375	76	19	6	8	—	—
Balsam poplar	112,306	46,786	25,464	15,789	11,462	7,070	3,431	1,326	559	286	82	38	13	—	—
Paper birch	385,022	138,222	110,543	68,401	40,664	17,216	6,476	1,938	886	407	167	36	66	—	—
Bigtooth aspen	5,390	853	926	1,318	1,193	663	244	115	47	18	9	4	—	—	—
Quaking aspen	699,079	354,455	124,136	82,212	67,911	39,151	19,612	7,388	2,583	1,070	387	103	70	1	—
Basswood	11,167	2,191	2,860	2,425	1,950	1,002	354	141	117	68	32	20	7	—	—
Elm	16,308	5,990	3,985	2,073	1,556	906	738	404	259	193	63	59	66	12	4
Select hardwoods	631	544	—	87	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	1,880	1,066	420	211	113	41	17	—	4	6	2	—	—	—	—
Noncommercial species	17,930	14,210	2,690	908	101	21	—	—	—	—	—	—	—	—	—
Total hardwoods	1,694,475	806,218	383,933	225,598	145,627	75,798	34,670	13,170	5,426	2,484	873	344	310	20	4
All species	3,466,197	1,592,828	921,842	493,038	253,445	118,797	51,737	19,874	8,258	3,731	1,509	598	488	48	4

Table 14.—*Number of growing-stock trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height)													
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	12,368	2,722	3,585	1,532	1,043	978	716	611	453	325	156	108	113	26	—
Red pine	31,991	13,257	4,214	5,020	3,737	2,657	1,490	832	371	175	170	54	14	—	—
Jack pine	35,364	1,473	4,836	10,040	9,094	5,717	2,970	833	363	27	9	—	2	—	—
White spruce	36,230	12,714	7,145	7,421	3,625	2,319	1,407	786	477	189	95	38	14	—	—
Black spruce	550,365	228,024	202,780	87,855	24,241	6,147	965	277	51	18	5	2	—	—	—
Balsam fir	668,902	322,399	198,814	96,061	36,260	11,697	2,882	695	80	9	5	—	—	—	—
Tamarack	84,419	33,142	31,316	13,203	4,969	1,157	510	96	20	6	—	—	—	—	—
Northern white-cedar	154,502	51,432	46,802	27,185	15,344	7,329	3,542	1,705	689	283	131	32	27	1	—
Other softwoods	315	—	270	30	15	—	—	—	—	—	—	—	—	—	—
Total softwoods	1,574,456	665,163	499,762	248,347	98,328	38,001	14,482	5,835	2,504	1,032	571	234	170	27	—
Hardwoods:															
Select white oaks	2,529	834	770	480	200	101	97	15	17	6	3	—	5	1	—
Select red oaks	1,855	262	269	473	312	287	134	72	35	9	2	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	1,819	712	570	134	100	45	112	48	37	30	15	6	10	—	—
Hard maple	65,281	36,408	18,227	6,890	2,136	1,003	240	197	129	30	13	4	4	—	—
Soft maple	85,414	46,794	25,905	9,020	2,509	604	394	162	20	6	—	—	—	—	—
Ash	191,103	103,259	46,169	23,903	9,910	5,018	1,601	822	340	56	17	2	6	—	—
Balsam poplar	97,790	41,769	21,269	13,356	10,148	6,405	3,069	1,148	434	139	40	7	6	—	—
Paper birch	328,755	113,599	96,588	60,059	36,606	14,709	5,236	1,286	448	116	94	8	6	—	—
Bigtooth aspen	4,433	567	656	1,200	1,072	586	198	91	40	12	9	2	—	—	—
Quaking aspen	584,299	299,235	101,012	68,808	58,448	33,027	15,790	5,552	1,689	496	162	43	37	—	—
Basswood	9,063	1,359	2,455	1,935	1,798	910	285	127	106	50	26	10	2	—	—
Elm	12,720	4,885	2,985	1,598	1,141	724	605	282	198	142	48	41	60	8	3
Select hardwoods	312	284	—	28	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	1,130	858	136	102	15	10	6	—	—	3	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	1,386,503	650,825	317,011	187,986	124,395	63,429	27,767	9,802	3,493	1,095	429	123	136	9	3
All species	2,960,959	1,315,988	816,773	436,333	222,723	101,430	42,249	15,637	5,997	2,127	1,000	357	306	36	3

Table 15.—*Number of short-log trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	74	37	8	8	17	3	—	—	1	—	—
Red pine	23	—	18	5	—	—	—	—	—	—	—
Jack pine	194	113	61	14	3	3	—	—	—	—	—
White spruce	9	—	5	—	4	—	—	—	—	—	—
Black spruce	100	92	8	—	—	—	—	—	—	—	—
Balsam fir	266	223	35	—	8	—	—	—	—	—	—
Tamarack	69	51	12	—	3	3	—	—	—	—	—
Northern white-cedar	1,325	553	458	178	51	72	11	2	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	2,060	1,069	605	205	86	81	11	2	1	—	—
Hardwoods:											
Select white oaks	4	—	—	—	4	—	—	—	—	—	—
Select red oaks	27	—	15	9	3	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	49	—	6	20	—	10	—	—	13	—	—
Hard maple	66	—	13	23	10	—	5	2	13	—	—
Soft maple	28	—	—	16	7	3	2	—	—	—	—
Ash	47	—	32	12	3	—	—	—	—	—	—
Balsam poplar	277	—	102	40	—	87	26	19	3	—	—
Paper birch	1,017	—	381	179	255	119	35	8	40	—	—
Bigtooth aspen	27	—	12	5	7	3	—	—	—	—	—
Quaking aspen	1,413	—	669	341	209	122	71	—	—	1	—
Basswood	7	—	—	—	3	3	—	—	1	—	—
Elm	108	—	37	35	18	9	2	2	4	—	1
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommericial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,070	—	1,267	680	519	356	141	31	74	1	1
All species	5,130	1,069	1,872	885	605	437	152	33	75	1	1

Table 16.—*Net volume of growing stock and sawtimber on commercial forest land by species, Aspen-Birch Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	1962[1]	1977	1962[1]	1977
	Thousand cubic feet		*Thousand board feet*[2]	
Softwoods:				
White pine	110,870	91,561	520,291	515,487
Red pine	128,207	147,197	603,099	596,918
Jack pine	419,188	212,572	801,907	589,587
Spruce	664,352	556,456	694,049	842,555
Balsam fir	498,522	559,387	515,571	741,009
Tamarack	130,428	75,063	121,350	86,831
Northern white-cedar	161,294	246,561	241,328	768,841
Other softwoods	—	138	—	—
Total softwoods	2,112,861	1,888,935	3,497,595	4,141,228
Hardwoods:				
White oak	3,584	5,277	10,509	13,774
Red oak	7,794	9,347	18,472	23,285
Yellow birch	9,722	6,861	44,638	27,091
Hard maple	36,426	43,352	123,036	56,909
Soft maple	26,389	38,495	65,083	30,931
Ash	152,374	196,644	271,058	312,399
Paper birch	436,083	620,775	254,367	591,221
Aspen	1,241,021	1,386,738	981,896	2,404,266
Basswood	20,945	35,262	62,747	64,530
Elm	40,599	45,431	149,441	176,959
Other hardwoods	158,765	244,958	242,942	482,003
Total hardwoods	2,133,702	2,633,140	2,224,189	4,183,368
All species	4,246,563	4,522,075	5,721,784	8,324,596

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey definitions and procedures

[2]International ¼-inch rule.

Table 17.— *Cubic foot volume in all live trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	95,990	2,863	4,417	9,849	9,569	10,866	13,763	12,383	8,646	6,850	12,003	4,781	—
Red pine	148,398	11,031	23,230	30,379	27,830	21,600	12,441	7,631	8,968	3,821	1,467	—	—
Jack pine	219,973	24,343	53,120	60,278	50,116	18,506	11,867	1,115	530	—	98	—	—
White spruce	138,372	18,462	20,377	23,957	23,774	18,399	15,896	8,330	5,469	2,543	1,165	—	—
Black spruce	428,442	205,257	131,174	63,453	17,671	7,566	1,985	954	330	52	—	—	—
Balsam fir	586,038	223,677	190,382	111,671	42,338	14,968	2,425	340	237	—	—	—	—
Tamarack	84,729	33,889	27,331	12,192	8,197	2,112	687	321	—	—	—	—	—
Northern white-cedar	284,598	48,300	62,683	61,780	45,031	30,133	18,116	9,931	5,637	1,446	1,434	107	—
Other softwoods	207	65	73	—	—	69	—	—	—	—	—	—	—
Total softwoods	1,986,747	567,887	512,787	373,559	224,526	124,219	77,180	41,005	29,817	14,712	16,167	4,888	—
Hardwoods:													
Select white oaks	5,632	879	905	882	1,033	340	648	237	104	—	497	107	—
Select red oaks	10,475	1,247	1,455	2,341	2,293	1,570	1,048	311	210	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	11,071	424	804	852	2,003	1,375	1,177	1,356	721	659	1,669	31	—
Hard maple	61,453	18,305	13,392	11,276	4,731	5,319	4,035	1,688	1,465	673	569	—	—
Soft maple	54,100	19,899	15,155	7,703	5,884	3,373	1,303	526	150	107	—	—	—
Ash	207,620	56,765	50,715	46,339	24,217	15,845	10,223	1,974	797	193	552	—	—
Balsam poplar	264,278	37,041	62,700	65,497	48,940	26,402	13,933	6,554	1,984	762	465	—	—
Paper birch	679,373	169,380	221,000	152,847	80,996	28,890	15,260	5,364	4,349	840	447	—	—
Bigtooth aspen	23,229	3,339	6,129	5,996	3,263	2,111	1,193	533	395	270	—	—	—
Quaking aspen	1,517,824	221,479	391,522	377,592	287,421	138,756	59,581	25,543	10,437	2,982	2,507	4	—
Basswood	37,297	4,996	10,547	8,200	3,873	2,708	2,908	1,919	1,155	658	333	—	—
Elm	51,819	3,547	5,568	6,406	7,737	6,479	5,695	5,630	2,401	2,464	4,413	984	495
Select hardwoods	78	78	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	890	196	226	195	152	—	13	104	4	—	—	—	—
Noncommercial species	972	631	200	141	—	—	—	—	—	—	—	—	—
Total hardwoods	2,926,111	538,206	780,318	686,267	472,543	233,168	117,017	51,739	24,172	9,608	11,452	1,126	495
All species	4,912,858	1,106,093	1,293,105	1,059,826	697,069	357,387	194,197	92,744	53,989	24,320	27,619	6,014	495

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock trees:			
Saw log trees:			
Saw log portion	1,212,135	621,522	590,613
Upper stem portion	446,139	236,504	209,635
Total sawtimber	1,658,274	858,026	800,248
Poletimber trees:	2,863,801	1,030,909	1,832,892
Total growing stock	4,522,075	1,888,935	2,633,140
Cull trees:			
Rough and rotten cull trees:			
Sawtimber	121,419	33,195	88,224
Poletimber	221,664	49,765	171,899
Total rough and rotten cull	343,083	82,960	260,123
Short-log cull trees:			
Sawtimber	47,700	14,852	32,848
Poletimber	—	—	—
Total short log	47,700	14,852	32,848
Total cull	390,783	97,812	292,971
Salvable dead trees:	27,448	16,717	10,731
All classes	4,940,306	2,003,464	2,936,842

Table 19.— *Net volume of growing stock on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	91,561	2,494	11,256	7,323	13,809	56,679
Red pine	147,197	14,588	357	15,430	19,651	97,171
Jack pine	212,572	1,767	21,913	20,709	26,106	142,077
White spruce	136,485	2,702	33,164	17,337	26,492	56,790
Black spruce	419,971	5,998	49,521	153,137	53,376	157,939
Balsam fir	559,387	17,047	97,165	100,736	85,162	259,277
Tamarack	75,063	5,999	787	34,458	5,401	28,418
Northern white-cedar	246,561	2,118	30,957	100,972	48,711	63,803
Other softwoods	138	—	—	—	—	138
Total softwoods	1,888,935	52,713	245,120	450,102	278,708	862,292
Hardwoods:						
Select white oaks	5,277	2,120	—	1,673	—	1,484
Select red oaks	9,347	6,690	—	—	325	2,332
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	6,861	—	162	91	4,521	2,087
Hard maple	43,352	6,936	6,181	1,250	20,407	8,578
Soft maple	38,495	4,509	2,682	2,122	4,321	24,861
Ash	196,644	23,854	3,640	50,649	21,115	97,386
Balsam poplar	244,477	10,724	4,789	81,560	28,460	118,944
Paper birch	620,775	33,721	96,544	47,414	172,099	270,997
Bigtooth aspen	21,001	1,117	—	790	431	18,663
Quaking aspen	1,365,737	56,205	171,395	262,098	158,010	718,029
Basswood	35,262	6,953	3,451	5,618	5,500	13,740
Elm	45,431	4,563	—	25,523	132	15,213
Select hardwoods	53	—	53	—	—	—
Other hardwoods	428	271	—	33	—	124
Noncommercial species	—	—	—	—	—	—
Total hardwoods	2,633,140	157,663	288,897	478,821	415,321	1,292,438
All species	4,522,075	210,376	534,017	928 923	694,029	2,154,730

Table 20.—*Net volume of sawtimber on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	515,487	15,826	65,334	44,097	72,580	317,650
Red pine	596,918	69,532	1,910	62,419	95,221	367,836
Jack pine	589,587	6,638	69,301	38,513	86,183	388,952
White spruce	471,316	11,572	115,955	56,365	103,042	184,382
Black spruce	371,239	377	71,871	114,828	42,325	141,838
Balsam fir	741,009	25,580	125,687	137,389	101,260	351,093
Tamarack	86,831	6,403	1,430	44,136	13,006	21,856
Northern white-cedar	768,841	3,701	114,968	286,040	186,391	177,741
Other softwoods	—	—	—	—	—	—
Total softwoods	4,141,228	139,629	566,456	783,787	700,008	1,951,348
Hardwoods:						
Select white oaks	13,774	4,419	—	6,333	—	3,022
Select red oaks	23,285	15,905	—	—	1,211	6,169
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	27,091	—	—	428	19,344	7,319
Hard maple	56,909	7,810	10,501	3,044	32,392	3,162
Soft maple	30,931	6,375	3,741	5,900	6,696	8,219
Ash	312,399	29,112	2,385	81,988	48,182	150,732
Balsam poplar	481,135	21,619	14,480	139,553	65,583	239,900
Paper birch	591,221	36,848	85,630	64,632	218,221	185,890
Bigtooth aspen	32,683	2,597	—	720	639	28,727
Quaking aspen	2,371,583	59,715	400,505	387,200	365,396	1,158,767
Basswood	64,530	11,280	—	15,248	8,824	29,178
Elm	176,959	12,147	—	105,611	356	58,845
Select hardwoods	—	—	—	—	—	—
Other hardwoods	868	502	—	—	—	366
Noncommercial species	—	—	—	—	—	—
Total hardwoods	4,183,368	208,329	517,242	810,657	766,844	1,880,296
All species	8,324,596	347,958	1,083,698	1,594,444	1,466,852	3,831,644

[1]International ¼-inch rule.

Table 21.— *Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Aspen-Birch Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short log	Rough and rotten	Sawtimber
	Thousand cubic feet				*Thousand board feet*[1]
Softwoods:					
White pine	95,990	91,561	1,080	3,349	515,487
Red pine	148,398	147,197	339	862	596,918
Jack pine	219,973	212,572	1,878	5,523	589,587
White spruce	138,372	136,485	147	1,740	471,316
Black spruce	428,442	419,971	787	7,684	371,239
Balsam fir	586,038	559,387	2,253	24,398	741,009
Tamarack	84,729	75,063	625	9,041	86,831
Northern white-cedar	284,598	246,561	7,743	30,294	768,841
Eastern redcedar	207	138	—	69	—
Total softwoods	1,986,747	1,888,935	14,852	82,960	4,141,228
Hardwoods:					
White oak	230	230	—	—	402
Burr oak	5,402	5,047	73	282	13,372
Swamp white oak	—	—	—	—	—
Northern red oak	10,475	9,347	380	748	23,285
Black oak	—	—	—	—	—
Northern pin oak	—	—	—	—	—
Bitternut hickory	—	—	—	—	—
Shagbark hickory	—	—	—	—	—
Yellow birch	11,071	6,861	1,482	2,728	27,091
Sugar maple	61,361	43,260	798	17,303	56,909
Black maple	92	92	—	—	—
Red maple	52,778	37,483	467	14,828	28,606
Silver maple	1,322	1,012	—	310	2,325
White ash	—	—	—	—	—
Black ash	199,086	188,695	440	9,951	301,531
Green ash	8,534	7,949	66	519	10,868
Balsam poplar	264,278	244,477	2,314	17,487	481,135
Paper birch	679,373	620,775	5,785	52,813	591,221
Bigtooth aspen	23,229	21,001	455	1,773	32,683
Quaking aspen	1,517,824	1,365,737	18,203	133,884	2,371,583
Basswood	37,297	35,262	279	1,756	64,530
American elm	50,943	44,716	2,106	4,121	175,349
Slippery elm	485	436	—	49	1,140
Rock elm	391	279	—	112	470
Butternut	—	—	—	—	—
Black walnut	—	—	—	—	—
Black cherry	78	53	—	25	—
Boxelder	331	71	—	260	—
River birch	—	—	—	—	—
Hackberry	—	—	—	—	—
Cottonwood	437	357	—	80	868
Black willow	122	—	—	122	—
Noncommercial	972	—	—	972	—
Total hardwoods	2,926,111	2,633,140	32,848	260,123	4,183,368
All species	4,912,858	4,522,075	47,700	343,083	8,324,596

[1]International ¼-inch rule.

Table 22.— *Net volume of growing stock on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (Inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	91,561	2,207	4,009	8,464	9,039	10,671	13,167	12,087	8,499	6,754	11,883	4,781	—
Red pine	147,197	10,859	22,930	30,188	27,503	21,457	12,441	7,563	8,968	3,821	1,467	—	—
Jack pine	212,572	23,776	51,157	57,710	48,894	18,069	11,510	984	374	—	98	—	—
White spruce	136,485	18,348	19,596	23,650	23,498	18,287	15,815	8,166	5,418	2,542	1,165	—	—
Black spruce	419,971	201,035	128,580	62,169	17,341	7,525	1,985	954	330	52	—	—	—
Balsam fir	559,387	213,602	183,157	105,535	40,004	14,410	2,162	280	237	—	—	—	—
Tamarack	75,063	29,838	24,168	10,917	7,377	1,921	609	233	—	—	—	—	—
Northern white-cedar	246,561	41,585	55,924	52,331	38,334	26,489	16,089	8,298	4,800	1,289	1,331	91	—
Other softwoods	138	65	73	—	—	—	—	—	—	—	—	—	—
Total softwoods	1,888,935	541,315	489,594	350,964	211,990	118,829	73,778	38,565	28,626	14,458	15,944	4,872	—
Hardwoods:													
Select white oaks	5,277	879	805	742	1,033	340	561	237	104	—	469	107	—
Select red oaks	9,347	1,061	1,450	2,308	1,860	1,288	922	311	147	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	6,861	372	440	351	1,309	924	918	945	696	339	567	—	—
Hard maple	43,352	15,622	9,799	7,831	2,680	3,080	2,681	772	495	183	209	—	—
Soft maple	38,495	15,831	10,127	4,548	4,346	2,792	644	207	—	—	—	—	—
Ash	196,644	54,256	47,731	43,596	22,716	15,281	9,805	1,913	797	97	452	—	—
Balsam poplar	244,477	33,731	57,951	62,273	46,428	24,151	12,487	5,117	1,591	413	335	—	—
Paper birch	620,775	157,071	206,068	139,564	73,240	25,104	11,756	3,909	3,350	429	284	—	—
Bigtooth aspen	21,001	3,024	5,779	5,545	2,785	1,826	1,062	446	395	139	—	—	—
Quaking aspen	1,365,737	201,908	359,433	345,507	258,004	121,250	49,696	18,353	7,525	2,152	1,909	—	—
Basswood	35,262	4,673	10,335	7,939	3,541	2,610	2,709	1,647	1,102	520	186	—	—
Elm	45,431	3,317	4,956	5,761	6,774	5,347	4,838	4,815	2,170	2,184	3,943	960	366
Select hardwoods	53	53	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	428	118	63	74	87	—	—	86	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	2,633,140	491,916	714,937	626,039	424,803	203,993	98,079	38,758	18,372	6,456	8,354	1,067	366
All species	4,522,075	1,033,231	1,204,531	977,003	636,793	322,822	171,857	77,323	46,998	20,914	24,298	5,939	366

Table 23.—*Net volume of sawtimber on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	515,487	44,453	59,859	67,161	79,556	72,328	51,855	40,964	70,668	28,643	—
Red pine	596,918	133,646	148,700	116,962	71,507	43,824	51,205	22,146	8,928	—	—
Jack pine	589,587	223,002	211,005	85,459	63,075	4,737	1,825	—	484	—	—
White spruce	471,316	92,052	103,389	92,871	83,935	44,967	31,893	14,498	7,711	—	—
Black spruce	371,239	244,431	75,485	34,570	9,477	4,991	1,693	592	—	—	—
Balsam fir	741,009	472,810	188,652	67,243	9,988	1,268	1,048	—	—	—	—
Tamarack	86,831	44,114	31,642	7,457	2,623	995	—	—	—	—	—
Northern white-cedar	768,841	269,771	197,575	135,850	79,568	42,234	26,649	8,020	8,317	857	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	4,141,228	1,524,279	1,016,307	607,573	399,729	215,344	166,168	86,220	96,108	29,500	—
Hardwoods:											
Select white oaks	13,774	—	6,033	1,847	2,588	1,013	422	—	1,545	326	—
Select red oaks	23,285	—	10,165	6,856	4,365	1,312	587	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27,091	—	6,356	5,047	4,706	4,203	3,281	1,366	2,132	—	—
Hard maple	56,909	—	16,782	17,650	13,480	4,376	2,654	944	1,023	—	—
Soft maple	30,931	—	14,044	13,186	2,789	912	—	—	—	—	—
Ash	312,399	—	149,056	90,720	55,630	10,352	4,012	548	2,081	—	—
Balsam poplar	481,135	—	238,924	131,589	69,985	28,338	8,502	2,096	1,701	—	—
Paper birch	591,221	—	367,071	131,617	56,420	19,567	13,479	1,895	1,172	—	—
Bigtooth aspen	32,683	—	13,631	9,026	4,980	2,371	1,921	754	—	—	—
Quaking aspen	2,371,583	—	1,297,446	635,764	271,806	100,486	42,653	11,869	11,559	—	—
Basswood	64,530	—	17,862	14,149	14,642	8,701	5,478	2,739	959	—	—
Elm	176,959	—	35,783	29,146	27,054	27,464	12,574	12,830	23,891	5,898	2,319
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	868	—	502	—	—	366	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,183,368	—	2,173,655	1,086,597	528,445	209,461	95,563	35,041	46,063	6,224	2,319
All species	8,324,596	1,524,279	3,189,962	1,694,170	928,174	424,805	261,731	121,261	142,171	35,724	2,319

[1]International ¼-inch rule.

Table 24.—*Net volume of growing stock on commercial forest land by species and forest type, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	91,561	1,628	14,561	25,430	9,916	437	2,616	2,540	422	—	972	2,901	24,304	5,728	106	—
Red pine	147,197	3,753	95,780	3,340	9,388	706	1,839	3,477	—	—	252	105	18,185	10,286	86	—
Jack pine	212,572	145,499	8,204	3,891	4,867	257	14,750	1,764	210	—	301	1,556	28,088	1,019	73	2,093
White spruce	136,485	1,007	3,462	6,209	29,222	15,130	8,280	1,863	77	—	3,699	4,868	44,700	14,642	3,326	—
Black spruce	419,971	12,381	1,083	554	39,978	920	281,064	26,549	8,652	—	1,735	794	40,981	3,282	1,697	301
Balsam fir	559,387	3,947	3,119	2,529	222,789	3,262	25,360	24,917	1,460	64	16,715	13,587	163,168	54,999	23,325	146
Tamarack	75,063	—	—	—	5,071	347	22,995	3,921	39,327	—	373	96	1,955	489	278	211
Northern white-cedar	246,561	—	312	211	31,528	1,194	6,634	153,146	1,877	—	9,771	10,112	20,956	6,657	3,939	224
Other softwoods	138	—	—	—	—	—	—	—	—	—	—	—	—	138	—	—
Total softwoods	1,888,935	168,215	126,521	42,164	352,759	22,253	363,538	218,177	52,025	64	33,818	34,019	342,337	97,240	32,830	2,975
Hardwoods:																
Select white oaks	5,277	—	—	—	—	—	—	—	—	446	712	607	2,968	328	216	—
Select red oaks	9,347	—	—	—	90	—	—	—	—	3,938	—	2,884	923	1,102	410	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	6,861	—	—	—	308	—	—	715	—	—	989	3,703	81	836	229	—
Hard maple	43,352	—	—	—	607	—	—	—	—	224	387	32,695	4,384	4,247	704	104
Soft maple	38,495	1,268	—	763	1,880	—	107	57	56	35	1,565	5,442	14,588	12,485	249	—
Ash	196,644	—	—	78	4,371	—	1,690	6,021	65	215	108,763	9,846	43,709	11,370	10,290	226
Balsam poplar	244,477	—	—	—	13,091	100	992	4,475	176	226	7,225	5,253	103,113	11,783	97,904	139
Paper birch	620,775	4,271	3,942	1,110	76,271	8,203	6,612	19,019	1,218	103	11,771	18,531	195,857	260,469	13,222	176
Bigtooth aspen	21,001	—	101	37	723	—	48	516	—	—	129	558	17,971	681	237	—
Quaking aspen	1,365,737	23,563	8,024	8,625	62,808	5,415	29,258	6,375	630	385	8,773	22,078	1,082,456	80,233	25,752	1,362
Basswood	35,262	—	—	—	416	—	—	—	—	—	1,222	21,318	7,701	4,086	519	—
Elm	45,431	—	—	—	515	—	—	118	—	90	14,673	10,191	12,873	1,602	5,225	144
Select hardwoods	53	—	—	—	—	—	—	—	—	—	—	—	53	—	—	—
Other hardwoods	428	—	—	—	—	—	—	—	—	—	71	—	357	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	2,633,140	29,102	12,067	10,613	161,080	13,718	38,707	37,296	2,145	5,662	156,280	133,106	1,487,034	389,222	154,957	2,151
All species	4,522,075	197,317	138,588	52,777	513,839	35,971	402,245	255,473	54,170	5,726	190,098	167,125	1,829,371	486,462	187,787	5,126

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	All types	Forest type													
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	515,487	5,506	67,563	148,331	61,154	3,296	15,369	15,558	2,713	—	7,419	17,801	141,106	28,970	701	—
Red pine	596,918	11,178	326,506	19,451	50,075	2,918	9,963	18,696	—	—	1,128	563	100,096	55,811	533	—
Jack pine	589,587	370,381	16,496	23,402	18,113	1,245	41,683	6,050	336	—	1,214	6,705	94,432	3,882	—	5,648
White spruce	471,316	2,146	12,356	27,605	104,565	47,705	25,590	7,335	—	—	14,441	21,690	132,078	63,889	11,916	—
Black spruce	371,239	7,688	998	645	59,527	—	152,034	51,107	5,791	—	3,260	1,720	74,652	8,252	4,970	595
Balsam fir	741,009	1,580	5,556	6,006	272,777	3,657	20,842	23,105	1,957	—	29,596	26,945	231,369	82,024	35,595	—
Tamarack	86,831	—	—	—	13,197	1,214	22,149	8,643	33,573	—	617	485	4,905	1,047	1,001	—
Northern white-cedar	768,841	—	1,101	428	100,271	5,160	10,411	442,963	5,694	—	33,352	45,689	83,077	26,369	13,617	709
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	4,141,228	398,479	430,576	225,868	679,679	65,195	298,041	573,457	50,064	—	91,027	121,598	861,715	270,244	68,333	6,952
Hardwoods:																
Select white oaks	13,774	—	—	—	—	—	—	—	—	718	2,314	2,578	7,762	402	—	—
Select red oaks	23,285	—	—	—	438	—	—	—	—	6,508	—	10,757	1,103	2,573	1,906	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27,091	—	—	—	646	—	—	2,236	—	—	4,322	15,102	—	3,890	895	—
Hard maple	56,909	—	—	—	—	—	—	—	—	1,070	699	49,526	2,124	3,490	—	—
Soft maple	30,931	—	—	—	6,696	—	—	—	—	—	3,334	8,817	11,313	771	—	—
Ash	312,399	—	—	—	10,088	—	6,719	12,377	—	—	170,439	18,354	63,108	17,567	13,747	—
Balsam poplar	481,135	—	—	—	10,873	—	1,048	10,753	509	395	18,124	17,938	210,774	22,868	187,853	—
Paper birch	591,221	381	690	792	117,811	10,555	3,637	35,251	756	—	14,568	34,785	147,170	208,745	15,836	244
Bigtooth aspen	32,683	—	—	—	2,475	—	—	1,176	—	—	—	856	27,189	987	—	—
Quaking aspen	2,371,583	48,501	11,018	34,742	97,697	10,272	30,116	12,415	2,278	—	20,882	45,502	1,804,246	191,536	61,292	1,086
Basswood	64,530	—	—	—	1,293	—	—	—	—	—	4,657	41,027	9,557	6,933	1,063	—
Elm	176,959	—	—	—	1,064	—	—	506	—	424	61,642	49,418	37,636	7,190	18,367	712
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	868	—	—	—	—	—	—	—	—	—	—	—	868	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,183,368	48,882	11,708	35,534	249,081	20,827	41,520	74,714	3,543	9,115	300,981	294,660	2,322,850	466,952	300,959	2,042
All species	8,324,596	447,361	442,284	261,402	928,760	86,022	339,561	648,171	53,607	9,115	392,008	416,258	3,184,565	737,196	369,292	8,994

[1]International ¼-inch rule.

Table 26.—*Net volume of growing stock on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	91,561	39,695	448	1,789	679	8,314	14,270	9,745	4,816	—	3,976	7,829	—	—
Red pine	147,197	62,268	—	4,279	—	17,704	19,009	9,062	10,149	—	3,657	21,069	—	—
Jack pine	212,572	116,794	77	114	2,450	32,281	23,962	13,114	5,405	—	6,688	11,421	266	—
White spruce	136,485	45,610	—	3,119	814	22,047	24,681	13,164	6,792	—	4,776	15,358	124	—
Black spruce	419,971	97,327	744	9,417	1,574	169,641	48,438	39,237	18,593	—	14,550	20,097	353	—
Balsam fir	559,387	134,772	186	12,059	1,914	98,520	128,787	62,951	40,212	—	31,744	48,242	—	—
Tamarack	75,063	5,654	82	457	127	39,384	13,433	4,461	5,085	—	1,646	4,734	—	—
Northern white-cedar	246,561	38,452	307	11,193	461	86,387	39,021	42,445	6,459	—	7,474	14,362	—	—
Other softwoods	138	—	—	—	—	—	138	—	—	—	—	—	—	—
Total softwoods	1,888,935	540,572	1,844	42,427	8,019	474,278	311,739	194,179	97,511	—	74,511	143,112	743	—
Hardwoods:														
Select white oaks	5,277	—	—	—	—	619	1,114	281	2,620	—	—	643	—	—
Select red oaks	9,347	—	—	314	52	265	1,446	2,437	1,965	—	168	2,700	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	6,861	461	—	—	—	609	4,595	218	181	—	589	208	—	—
Hard maple	43,352	4,684	—	304	297	5,360	14,866	4,516	5,008	—	1,316	6,931	70	—
Soft maple	38,495	15,460	—	321	498	2,632	7,002	3,440	5,684	—	1,173	2,285	—	—
Ash	196,644	39,324	—	2,777	—	32,226	45,190	15,850	34,875	—	5,953	20,449	—	—
Balsam poplar	244,477	49,400	—	3,019	462	41,423	64,218	27,134	25,124	—	9,169	24,528	—	—
Paper birch	620,775	168,291	1,127	11,302	1,330	79,998	135,111	46,125	55,051	—	42,431	79,399	88	522
Bigtooth aspen	21,001	—	—	—	—	6,254	4,484	2,291	3,962	—	447	3,563	—	—
Quaking aspen	1,365,737	407,508	432	17,708	7,933	178,412	326,821	126,446	136,724	—	48,627	112,017	2,683	426
Basswood	35,262	3,451	—	299	—	2,261	9,616	4,015	7,087	—	785	7,748	—	—
Elm	45,431	1,417	—	697	—	9,866	13,067	5,763	8,311	—	751	5,559	—	—
Select hardwoods	53	—	—	—	—	53	—	—	—	—	—	—	—	—
Other hardwoods	428	—	—	—	—	—	—	—	428	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	2,633,140	689,996	1,559	36,741	10,572	359,978	627,530	238,516	287,020	—	111,409	266,030	2,841	948
All species	4,522,075	1,230,568	3,403	79,168	18,591	834,256	939,269	432,695	384,531	—	185,920	409,142	3,584	948

Table 27.— *Net volume of sawtimber on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand board feet[1])

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	515,487	192,115	1,625	9,575	4,061	51,192	82,538	65,496	32,679	—	24,138	52,068	—	—
Red pine	596,918	194,461	—	18,836	—	88,706	86,356	38,508	49,394	—	17,236	103,421	—	—
Jack pine	589,587	303,033	402	551	9,740	96,127	69,644	34,245	18,575	—	24,654	31,737	879	—
White spruce	471,316	166,475	—	13,327	1,759	64,447	87,114	43,693	26,004	—	17,102	50,927	468	—
Black spruce	371,239	129,882	—	4,157	457	128,448	33,142	38,495	8,935	—	10,444	17,279	—	—
Balsam fir	741,009	145,895	354	19,412	2,790	126,633	193,860	81,518	60,557	—	38,513	71,477	—	—
Tamarack	86,831	10,279	—	1,301	—	45,849	8,521	5,094	6,109	—	767	8,911	—	—
Northern white-cedar	768,841	129,165	772	22,130	2,682	258,921	130,229	139,810	13,213	—	28,493	43,426	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	4,141,228	1,271,305	3,153	89,289	21,489	860,323	691,404	446,859	215,466	—	161,347	379,246	1,347	—
Hardwoods:														
Select white oaks	13,774	—	—	—	—	2,165	4,359	753	5,359	—	—	1,138	—	—
Select red oaks	23,285	—	—	1,581	—	312	4,932	2,335	7,224	—	—	6,901	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27,091	1,606	—	—	—	1,944	18,598	1,213	575	—	3,155	—	—	—
Hard maple	56,909	6,668	—	457	416	8,344	21,546	2,780	6,268	—	424	10,006	—	—
Soft maple	30,931	10,437	—	622	476	3,150	3,657	3,545	6,372	—	1,271	1,401	—	—
Ash	312,399	70,742	—	4,689	—	49,842	71,389	28,362	53,028	—	7,979	26,368	—	—
Balsam poplar	481,135	107,536	—	8,126	458	78,224	132,341	48,125	42,965	—	18,070	45,290	—	—
Paper birch	591,221	190,570	—	13,899	1,527	78,309	97,345	55,887	46,166	—	24,639	82,569	—	310
Bigtooth aspen	32,683	—	—	—	—	3,860	10,105	5,826	7,349	—	544	4,999	—	—
Quaking aspen	2,371,583	770,336	1,057	28,997	17,932	324,409	514,440	234,598	204,185	—	104,287	168,838	2,168	336
Basswood	64,530	—	—	430	—	5,168	19,149	5,278	15,377	—	787	18,341	—	—
Elm	176,959	8,614	—	1,268	—	36,783	53,710	24,218	30,775	—	2,512	19,079	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	868	—	—	—	—	—	—	—	868	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,183,368	1,166,509	1,057	60,069	20,809	592,510	951,571	412,920	426,511	—	163,668	384,930	2,168	646
All species	8,324,596	2,437,814	4,210	149,358	42,298	1,452,833	1,642,975	859,779	641,977	—	325,015	764,176	3,515	646

[1]International ¼-inch rule.

Table 28.—*Net volume of growing stock on commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand cubic feet)

Forest type	All ages	Stand-age class(years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	197,317	338	208	2,741	17,678	38,880	63,381	48,443	1,993	12,811	8,299	2,545	—	—
Red pine	138,588	1,497	2,684	1,247	31,306	17,004	24,517	5,218	23,377	28,126	2,222	1,390	—	—
White pine	52,777	—	491	—	—	413	—	7,326	18,954	1,710	22,683	1,200	—	—
Balsam fir	513,839	10,183	14,834	17,926	55,289	168,353	160,164	48,417	12,683	10,025	13,682	2,283	—	—
White spruce	35,971	304	240	717	4,189	15,454	3,820	1,465	1,530	2,087	5,173	992	—	—
Black spruce	402,245	1,829	14,765	22,929	30,488	50,623	82,648	47,238	68,283	30,080	35,722	6,944	10,696	—
Northern white-cedar	255,473	193	1,335	2,810	7,340	7,869	14,137	28,035	24,109	40,187	44,176	31,325	53,957	—
Tamarack	54,170	1,570	6,016	4,665	2,409	5,961	5,826	7,235	3,799	3,856	685	8,440	3,202	506
Oak	5,726	—	—	—	603	3,199	1,924	—	—	—	—	—	—	—
Elm-ash-cottonwood	190,098	3,697	5,988	2,078	3,789	19,145	27,889	32,943	15,680	40,360	17,779	9,111	11,639	—
Maple-basswood	167,125	961	4,401	2,173	7,470	27,788	25,836	14,136	18,164	14,284	30,199	12,607	9,106	—
Aspen	1,829,371	56,339	57,303	88,067	229,456	488,537	534,057	253,495	71,564	38,619	11,076	858	—	—
Paper birch	486,462	3,836	10,335	9,162	39,665	141,005	131,037	52,297	59,517	29,739	7,911	1,958	—	—
Balsam poplar	187,787	6,003	3,876	4,288	32,826	63,008	33,734	20,167	15,975	6,422	1,488	—	—	—
Nonstocked	5,126	5,126	—	—	—	—	—	—	—	—	—	—	—	—
All types	4,522,075	91,876	122,476	158,803	462,508	1,047,239	1,108,970	566,415	335,628	258,306	201,095	79,653	88,600	506

Table 29.—*Net volume of sawtimber on commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand board feet[1])

Forest type	All ages	Stand-age class(years) 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	447,361	287	402	1,586	22,735	76,112	177,968	97,961	8,424	32,780	21,804	7,302	—	—
Red pine	442,284	6,764	10,466	1,423	47,782	48,626	82,341	21,833	88,726	117,570	10,746	6,007	—	—
White pine	261,402	—	3,736	—	—	2,711	—	31,771	98,507	6,579	109,870	8,228	—	—
Balsam fir	928,760	21,833	36,307	32,386	65,832	227,545	306,874	110,666	38,026	29,952	52,692	6,647	—	—
White spruce	86,022	—	—	2,987	6,443	18,527	5,162	3,684	5,938	10,315	28,260	4,706	—	—
Black spruce	339,561	1,546	7,197	7,564	16,513	40,114	76,316	30,047	93,239	30,070	22,870	5,002	9,083	—
Northern white-cedar	648,171	533	2,078	2,603	9,472	16,724	20,617	57,563	45,506	112,824	89,690	91,661	198,900	—
Tamarack	53,607	1,749	7,765	1,579	2,910	2,764	3,836	7,213	5,973	2,415	—	12,140	5,263	—
Oak	9,115	—	—	—	1,437	3,391	4,287	—	—	—	—	—	—	—
Elm-ash-cottonwood	392,008	3,000	12,365	1,839	8,880	24,127	45,119	54,155	34,473	91,512	51,196	23,313	42,029	—
Maple-basswood	416,258	2,030	8,147	2,011	8,066	45,355	45,337	38,283	65,281	52,794	64,797	46,194	37,963	—
Aspen	3,184,565	86,134	72,668	104,402	250,915	662,870	987,692	633,930	203,659	148,720	30,806	2,769	—	—
Paper birch	737,196	2,562	13,202	19,029	39,971	142,367	145,763	87,561	149,223	107,895	25,055	4,568	—	—
Balsam poplar	369,292	11,151	3,487	4,918	48,454	104,350	59,147	57,859	51,810	23,233	4,883	—	—	—
Nonstocked	8,994	8,994	—	—	—	—	—	—	—	—	—	—	—	—
All types	8,324,596	146,583	177,820	182,327	529,410	1,415,583	1,960,459	1,232,526	888,785	766,659	512,669	218,537	293,238	—

[1]International 1/4-inch rule.

Table 30.— *Net volume of short-log trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	1,080	311	85	134	341	89	--	—	120	—	—
Red pine	339	—	265	74	—	—	—	—	—	—	—
Jack pine	1,878	797	681	216	112	72	—	—	—	—	—
White spruce	147	—	66	—	81	—	—	—	—	—	—
Black spruce	787	696	91	—	—	—	—	—	—	—	—
Balsam fir	2,253	1,753	329	—	171	—	—	—	—	—	—
Tamarack	625	309	167	—	61	88	—	—	—	—	—
Northern white-cedar	7,743	2,991	2,161	890	731	753	175	42	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	14,852	6,857	3,845	1,314	1,497	1,002	175	42	120	—	—
Hardwoods:											
Select white oaks	73	—	—	—	73	—	—	—	—	—	—
Select red oaks	380	—	162	137	81	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	1,482	—	80	267	—	211	—	—	924	—	—
Hard maple	798	—	109	251	233	—	136	60	9	—	—
Soft maple	467	—	—	186	146	60	75	—	—	—	—
Ash	506	—	256	164	86	—	—	—	—	—	—
Balsam poplar	2,314	—	271	570	—	887	254	225	107	—	—
Paper birch	5,785	—	2,093	1,218	1,494	166	661	134	19	—	—
Bigtooth aspen	455	—	160	105	131	59	—	—	—	—	—
Quaking aspen	18,203	—	7,209	4,195	3,404	2,499	892	—	—	4	—
Basswood	279	—	—	—	62	91	—	—	126	—	—
Elm	2,106	—	324	422	366	268	52	98	447	—	129
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	-	—	—	—	—	—	—
Total hardwoods	32,848	—	10,664	7,515	6,076	4,241	2,070	517	1,632	4	129
All species	47,700	6,857	14,509	8,829	7,573	5,243	2,245	559	1,752	4	129

Table 31.— *Net volume of short-log trees on commercial forest land by species and diameter class, Aspen-Birch Unit, Minnesota, 1977*

(In thousand board feet[1])

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	4,653	1,181	387	690	1,613	411	—	—	371	—	—
Red pine	1,593	—	1,246	347	—	—	—	—	—	—	—
Jack pine	7,854	3,463	2,893	657	522	319	—	—	—	—	—
White spruce	759	—	332	—	427	—	—	—	—	—	—
Black spruce	2,957	2,589	368	—	—	—	—	—	—	—	—
Balsam fir	9,095	6,412	1,540	—	1,143	—	—	—	—	—	—
Tamarack	2,701	1,135	655	—	455	456	—	—	—	—	—
Northern white-cedar	29,491	12,649	8,666	3,060	2,300	2,219	485	112	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	59,103	27,429	16,087	4,754	6,460	3,405	485	112	371	—	—
Hardwoods:											
Select white oaks	274	—	—	—	274	—	—	—	—	—	—
Select red oaks	1,455	—	653	474	328	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	2,856	—	226	929	—	838	—	—	863	—	—
Hard maple	3,179	—	321	862	922	—	674	358	42	—	—
Soft maple	1,923	—	—	814	645	273	191	—	—	—	—
Ash	1,792	—	1,032	493	267	—	—	—	—	—	—
Balsam poplar	11,573	—	798	1,906	—	5,345	1,518	1,489	517	—	—
Paper birch	19,401	—	6,338	4,268	2,612	739	4,300	1,024	120	—	—
Bigtooth aspen	1,497	—	403	347	525	222	—	—	—	—	—
Quaking aspen	69,351	—	25,062	14,437	15,644	9,545	4,660	—	—	3	—
Basswood	862	—	—	—	134	337	—	—	391	—	—
Elm	8,158	—	1,508	1,983	1,414	1,024	157	329	1,391	—	352
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	122,321	—	36,341	26,513	22,765	18,323	11,500	3,200	3,324	3	352
All species	181,424	27,429	52,428	31,267	29,225	21,728	11,985	3,312	3,695	3	352

[1]International ¼-inch rule.

Table 32.— *Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1961[1] and 1976*

(In thousand cubic feet)

Species	1961	1976
Softwoods	68,124	56,982
Hardwoods	94,826	57,917
All species	162,950	114,899

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey procedures and definitions.

Table 33.—*Net annual growth of growing stock on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	2,367	77	194	250	191	1,655
Red pine	5,811	540	6	536	497	4,232
Jack pine	5,799	64	471	630	835	3,799
White spruce	7,328	158	1,413	1,381	1,210	3,166
Black spruce	11,358	99	923	3,847	1,861	4,628
Balsam fir	17,912	603	1,564	5,013	−671	11,403
Tamarack	−343	−176	20	−132	222	−277
Northern white-cedar	6,747	31	752	3,259	405	2,300
Other softwoods	3	—	—	—	—	3
Total softwoods	56,982	1,396	5,343	14,784	4,550	30,909
Hardwoods:						
Select white oaks	140	63	—	40	—	37
Select red oaks	191	135	—	—	8	48
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	30	—	−13	1	−4	46
Hard maple	1,298	477	163	28	368	262
Soft maple	1,574	95	249	38	132	1,060
Ash	3,996	365	99	387	468	2,677
Balsam poplar	6,229	28	208	3,371	594	2,028
Paper birch	10,619	769	2,358	752	3,031	3,709
Bigtooth aspen	409	21	—	20	8	360
Quaking aspen	31,322	−830	2,497	9,998	840	18,817
Basswood	891	169	133	123	120	346
Elm	1,248	167	—	674	5	402
Select hardwoods	4	—	4	—	—	—
Other hardwoods	−34	−21	—	−6	—	−7
Noncommercial species	—	—	—	—	—	—
Total hardwoods	57,917	1,438	5,698	15,426	5,570	29,785
All species	114,899	2,834	11,041	30,210	10,120	60,694

Table 34.—*Net annual growth of sawtimber on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	15,969	380	1,650	1,643	2,300	9,996
Red pine	25,414	3,796	35	1,191	4,131	16,261
Jack pine	30,665	214	5,935	3,426	3,215	17,875
White spruce	23,581	1,224	4,578	2,738	5,740	9,301
Black spruce	14,758	−382	2,362	2,036	1,662	9,080
Balsam fir	48,647	2,057	8,611	10,772	590	26,617
Tamarack	6	181	35	784	615	−1,609
Northern white-cedar	19,486	656	3,941	7,328	871	6,690
Other softwoods	—	—	—	—	—	—
Total softwoods	178,526	8,126	27,147	29,918	19,124	94,211
Hardwoods:						
Select white oaks	199	76	—	86	—	37
Select red oaks	658	578	—	—	14	66
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	428	—	—	4	339	85
Hard maple	2,639	102	686	393	1,415	43
Soft maple	1,574	57	423	49	743	302
Ash	6,377	775	29	766	1,681	3,126
Balsam poplar	22,274	−656	418	6,440	2,604	13,468
Paper birch	23,611	1,396	3,554	1,309	5,920	11,432
Bigtooth aspen	1,130	30	—	11	9	1,080
Quaking aspen	132,104	2,970	18,251	24,019	14,922	71,942
Basswood	2,452	553	—	645	131	1,123
Elm	6,113	187	—	3,529	16	2,381
Select hardwoods	—	—	—	—	—	—
Other hardwoods	−19	−15	—	—	—	−4
Noncommercial species	—	—	—	—	—	—
Total hardwoods	199,540	6,053	23,361	37,251	27,794	105,081
All species	378,066	14,179	50,508	67,169	46,918	199,292

[1]International ¼-inch rule.

Table 35.—*Net annual growth of growing stock on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	2,367	530	27	68	21	241	566	388	133	—	132	261	—	—
Red pine	5,811	2,683	—	131	—	486	645	335	261	—	116	1,154	—	—
Jack pine	5,799	2,974	1	1	80	800	1,022	395	66	—	123	327	10	—
White spruce	7,328	1,777	—	117	45	2,394	1,321	411	356	—	243	651	13	—
Black spruce	11,358	2,386	29	178	18	3,910	2,127	1,102	545	—	490	557	16	—
Balsam fir	17,912	1,816	5	945	102	3,533	7,186	819	1,676	—	802	1,028	—	—
Tamarack	−343	326	2	−295	6	−646	−258	145	181	—	59	137	—	—
Northern white-cedar	6,747	653	8	423	9	2,649	985	1,008	283	—	230	499	—	—
Other softwoods	3	—	—	—	—	—	3	—	—	—	—	—	—	—
Total softwoods	56,982	13,145	72	1,568	281	13,367	13,597	4,603	3,501	—	2,195	4,614	39	—
Hardwoods:														
Select white oaks	140	—	—	—	—	18	19	5	81	—	—	17	—	—
Select red oaks	191	—	—	6	1	9	24	50	33	—	5	63	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	30	−84	—	—	—	13	75	4	4	—	8	10	—	—
Hard maple	1,298	125	—	7	9	133	188	−140	419	—	39	515	3	—
Soft maple	1,574	1,028	—	8	10	58	207	72	118	—	25	48	—	—
Ash	3,996	2,030	—	61	—	179	158	143	822	—	137	466	—	—
Balsam poplar	6,229	2,020	—	101	14	209	1,480	708	1,403	—	472	−178	—	—
Paper birch	10,619	948	22	166	28	1,607	3,446	901	1,426	—	840	1,214	1	20
Bigtooth aspen	409	—	—	—	—	140	73	39	65	—	14	78	—	—
Quaking aspen	31,322	10,124	19	1,403	358	5,299	7,145	3,704	1,263	—	−788	2,843	−72	24
Basswood	891	133	—	8	—	55	229	105	171	—	19	171	—	—
Elm	1,248	−35	—	31	—	211	368	199	226	—	27	221	—	—
Select hardwoods	4	—	—	—	—	4	—	—	—	—	—	—	—	—
Other hardwoods	−34	—	—	—	—	—	—	—	−34	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	57,917	16,289	41	1,791	420	7,935	13,412	5,790	5,997	—	798	5,468	−68	44
All species	114,899	29,434	113	3,359	701	21,302	27,009	10,393	9,498	—	2,993	10,082	−29	44

Table 36.— *Net annual growth of sawtimber on commercial forest land by species and ownership class, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	Ownership class													
	All owners	National forest	Bureau of land mgmt.	Indian	Misc. Federal	State	County and municipal	Forest industry	Farmer	Farmer-owned, leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	15,969	6,418	64	301	92	1,198	2,522	2,663	697	—	572	1,442	—	—
Red pine	25,414	11,362	—	329	—	1,977	3,581	2,243	957	—	424	4,541	—	—
Jack pine	30,665	18,951	6	5	312	2,714	2,234	3,807	809	—	489	1,311	27	—
White spruce	23,581	6,305	—	847	105	4,133	5,081	1,016	1,834	—	996	3,203	61	—
Black spruce	14,758	8,326	—	44	15	2,693	1,437	1,372	266	—	298	307	—	—
Balsam fir	48,647	8,032	9	1,245	108	9,804	16,495	5,036	4,199	—	3	3,716	—	—
Tamarack	6	538	—	19	—	−1,992	521	140	162	—	22	596	—	—
Northern white-cedar	19,486	4,353	14	1,069	55	6,360	3,231	1,528	346	—	1,212	1,318	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	178,526	64,285	93	3,859	687	26,887	35,102	17,805	9,270	—	4,016	16,434	88	—
Hardwoods:														
Select white oaks	199	—	—	—	—	36	50	7	89	—	—	17	—	—
Select red oaks	658	—	—	20	—	5	48	407	85	—	—	93	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	428	154	—	—	—	23	187	18	10	—	36	—	—	—
Hard maple	2,639	626	—	6	6	404	1,011	33	80	—	6	467	—	—
Soft maple	1,574	1,166	—	5	3	30	32	33	286	—	10	9	—	—
Ash	6,377	1,569	—	44	—	−280	1,236	1,305	1,222	—	100	1,181	—	—
Balsam poplar	22,274	4,184	—	169	5	3,775	6,839	2,936	3,430	—	436	500	—	—
Paper birch	23,611	10,935	—	126	15	741	3,187	1,550	3,463	—	574	3,014	—	6
Bigtooth aspen	1,130	—	—	—	—	269	306	60	87	—	6	402	—	—
Quaking aspen	132,104	40,997	36	1,183	551	19,310	39,497	13,345	8,831	—	−2,438	10,709	64	19
Basswood	2,452	—	—	8	—	78	1,011	817	255	—	13	270	—	—
Elm	6,113	245	—	46	—	602	1,943	745	1,411	—	70	1,051	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	−19	—	—	—	—	—	—	—	−19	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	199,540	59,876	36	1,607	580	24,993	55,347	21,256	19,230	—	−1,187	17,713	64	25
All species	378,066	124,161	129	5,466	1,267	51,880	90,449	39,061	28,500	—	2,829	34,147	152	25

[1]International ¼-inch rule.

Table 37.—*Net annual growth of growing stock on commercial forest land by species and forest type, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	2,367	54	276	379	264	18	81	36	19	—	33	119	891	196	1	—
Red pine	5,811	109	3,804	40	256	20	48	59	—	—	8	1	1,119	344	3	—
Jack pine	5,799	4,162	258	29	129	3	394	85	10	—	11	−4	645	29	−34	82
White spruce	7,328	78	175	222	1,216	844	429	7	7	—	67	196	3,291	630	166	—
Black spruce	11,358	223	36	−80	1,433	42	8,431	−3	264	—	37	−22	985	−49	51	10
Balsam fir	17,912	257	110	−581	5,197	112	844	136	30	5	376	−95	7,676	3,156	681	8
Tamarack	−343	—	—	—	169	−822	490	−124	−164	—	7	3	50	19	8	11
Northern white-cedar	6,747	—	11	8	915	24	211	4,149	85	—	243	80	732	128	153	8
Other softwoods	3	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—
Total softwoods	56,982	4,883	4,670	17	9,579	241	10,928	4,345	251	5	782	278	15,399	4,456	1,029	119
Hardwoods:																
Select white oaks	140	—	—	—	—	—	—	—	—	14	10	14	86	10	6	—
Select red oaks	191	—	—	—	1	—	—	—	—	85	—	51	23	25	6	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	30	—	—	—	7	—	—	15	—	—	18	−31	2	17	2	—
Hard maple	1,298	—	—	—	19	—	—	—	—	5	8	810	320	112	22	2
Soft maple	1,574	142	—	37	25	—	3	1	1	1	29	115	585	626	9	—
Ash	3,996	—	—	2	123	−310	41	−95	2	7	2,021	4	1,632	287	274	8
Balsam poplar	6,229	—	—	—	−926	5	29	113	4	9	223	−115	3,876	399	2,606	6
Paper birch	10,619	83	28	−107	2,100	288	204	37	22	1	85	311	2,016	5,251	297	3
Bigtooth aspen	409	—	2	1	12	—	1	10	—	—	4	8	348	17	6	—
Quaking aspen	31,322	975	−369	162	1,919	400	983	165	−145	15	54	395	26,235	101	362	70
Basswood	891	—	—	—	8	—	—	—	—	—	21	529	214	107	12	—
Elm	1,248	—	—	—	23	−129	—	4	—	2	381	216	478	56	213	4
Select hardwoods	4	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—
Other hardwoods	−34	—	—	—	—	—	—	—	—	—	−12	—	−22	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	57,917	1,200	−339	95	3,311	254	1,261	250	−116	139	2,842	2,307	35,797	7,008	3,815	93
All species	114,899	6,083	4,331	112	12,890	495	12,189	4,595	135	144	3,624	2,585	51,196	11,464	4,844	212

Table 38.— *Net annual growth of sawtimber on commercial forest land by species and forest type, Aspen-Birch Unit, 1976*
(In thousand board feet[1])

Species	Forest type															
	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	No. white-cedar	Tamarack	Oak	Elm-ash cotton-wood	Maple-bass-wood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	15,969	148	2,871	4,236	1,349	119	471	243	97	—	196	612	4,608	1,011	8	—
Red pine	25,414	323	15,052	642	1,080	52	204	636	—	—	24	7	5,862	1,516	16	—
Jack pine	30,665	20,019	1,046	108	407	12	3,197	373	12	—	38	−26	5,290	97	−184	276
White spruce	23,581	208	976	1,981	4,672	2,771	856	−37	—	—	138	972	7,125	3,274	645	—
Black spruce	14,758	568	16	4	3,068	—	4,111	−94	190	—	25	715	5,878	181	85	11
Balsam fir	48,647	58	683	157	13,027	−117	1,507	120	86	—	60	1,395	20,804	8,365	2,502	—
Tamarack	6	—	—	—	913	−2,814	418	130	772	—	11	16	492	37	31	—
Northern white-cedar	19,486	—	36	8	2,191	115	840	7,879	532	—	924	969	5,414	158	401	19
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	178,526	21,324	20,680	7,136	26,707	138	11,604	9,250	1,689	—	1,416	4,660	55,473	14,639	3,504	306
Hardwoods:																
Select white oaks	199	—	—	—	—	—	—	—	—	12	21	35	127	4	—	—
Select red oaks	658	—	—	—	5	—	—	—	—	466	—	118	15	32	22	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	428	—	—	—	6	—	—	24	—	—	54	285	—	53	6	—
Hard maple	2,639	—	—	—	—	—	—	—	—	13	9	2,538	30	49	—	—
Soft maple	1,574	—	—	—	751	—	—	—	—	—	24	301	491	7	—	—
Ash	6,377	—	—	—	273	−1,516	114	90	—	—	2,493	215	3,001	774	933	—
Balsam poplar	22,274	—	—	—	263	—	22	856	11	11	340	326	10,122	1,005	9,318	—
Paper birch	23,611	4	10	9	4,091	392	22	74	7	—	118	1,152	9,633	7,886	211	2
Bigtooth aspen	1,130	—	—	—	24	—	—	10	—	—	—	8	1,074	14	—	—
Quaking aspen	132,104	3,433	1,134	788	4,830	243	2,399	234	51	—	865	892	105,245	6,990	4,955	45
Basswood	2,452	—	—	—	20	—	—	—	—	—	451	1,277	574	110	20	—
Elm	6,113	—	—	—	37	−520	—	18	—	12	2,493	1,062	1,677	227	1,086	21
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	-19	—	—	—	—	—	—	—	—	—	—	—	−19	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	199,540	3,437	1,144	797	10,300	−1,401	2,557	1,306	69	514	6,868	8,209	131,970	17,151	16,551	68
All species	378,066	24,761	21,824	7,933	37,007	−1,263	14,161	10,556	1,758	514	8,284	12,869	187,443	31,790	20,055	374

[1]International ¼-inch rule.

Table 39.—*Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Aspen-Birch Unit, Minnesota, 1976*

(In thousand cubic feet)

Forest type	Stand-age class(years)												
	All ages	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	6,083	18	6	470	1,299	1,702	1,666	995	53	−86	−89	49	—	—
Red pine	4,331	43	119	93	1,893	416	884	170	119	491	68	35	—	—
White pine	112	−29	20	—	—	3	—	202	79	71	−247	13	—	—
Balsam fir	12,890	327	81	565	2,465	6,041	2,227	1,773	−386	−446	173	70	—	—
White spruce	495	−395	14	40	217	−94	445	67	30	50	101	20	—	—
Black spruce	12,189	15	628	742	857	1,888	2,765	1,420	2,014	610	912	54	284	—
Northern white−cedar	4,595	8	46	24	125	35	492	648	574	918	567	328	830	—
Tamarack	135	53	5	−13	99	−156	214	241	123	−696	19	196	38	12
Oak	144	—	—	—	15	78	51	—	—	—	—	—	—	—
Elm−ash−cottonwood	3,624	−554	170	70	114	574	705	946	386	596	190	298	129	—
Maple−basswood	2,585	30	16	19	237	604	737	380	−305	350	703	−380	194	—
Aspen	51,196	1,424	2,061	3,717	9,100	11,926	16,164	5,466	602	343	413	−20	—	—
Paper birch	11,464	52	517	345	1,344	3,988	2,796	813	993	710	−132	38	—	—
Balsam poplar	4,844	−441	189	193	1,186	2,134	567	321	482	173	40	—	—	—
Nonstocked	212	212	—	—	—	—	—	—	—	—	—	—	—	—
All types	114,899	763	3,872	6,265	18,951	29,139	29,713	13,442	4,764	3,084	2,718	701	1,475	12

Table 40.—*Net annual growth of sawtimber on commercial forest land by forest type and stand-age, Aspen-Birch Unit, Minnesota, 1976*

(In thousand board feet[1])

Forest type	Stand-age class(years)												
	All ages	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	24,761	5	19	72	1,272	4,602	11,096	5,340	187	986	1,059	123	—	—
Red pine	21,824	141	1,138	76	5,869	2,877	3,958	496	1,983	4,472	255	559	—	—
White pine	7,933	—	131	—	—	−13	—	1,899	1,920	213	3,730	53	—	—
Balsam fir	37,007	1,344	359	801	3,925	13,177	14,517	3,343	−424	−705	509	161	—	—
White spruce	−1,263	−2,036	—	213	198	−1,866	285	521	117	217	988	100	—	—
Black spruce	14,161	44	734	190	1,179	2,063	3,991	1,038	2,540	563	1,590	91	138	—
Northern white−cedar	10,556	9	48	68	212	−687	291	1,610	1,733	3,849	1,496	−37	1,964	—
Tamarack	1,758	41	250	48	83	97	115	195	178	45	—	617	89	—
Oak	514	—	—	—	18	436	60	—	—	—	—	—	—	—
Elm−ash−cottonwood	8,284	475	268	40	227	580	1,363	1,669	828	1,330	−193	1,179	518	—
Maple−basswood	12,869	47	1,583	−190	−233	1,536	1,325	1,460	473	1,071	3,381	1,007	1,409	—
Aspen	187,443	5,015	2,858	10,725	24,275	44,727	52,783	33,307	7,296	4,839	1,270	348	—	—
Paper birch	31,790	99	399	1,275	4,392	9,045	4,460	3,462	3,309	4,306	985	58	—	—
Balsam poplar	20,055	−1,786	135	180	4,448	8,388	2,892	2,474	1,816	979	529	—	—	—
Nonstocked	374	374	—	—	—	—	—	—	—	—	—	—	—	—
All types	378,066	3,772	7,922	13,498	45,865	84,962	97,136	56,814	21,956	22,165	15,599	4,259	4,118	—

[1]International 1/4-inch rule

Table 41.—*Timber removals from growing stock and sawtimber on commericial forest land by species, Aspen-Birch Unit, Minnesota, 1962[1] and 1976*

Species	Growing stock		Sawtimber	
	1962	1976	1962	1976
	Thousand cubic feet		*Thousand board feet[2]*	
Softwoods:				
White pine	1,975	1,711	11,785	7,641
Red pine	1,018	1,485	5,013	4,210
Jack pine	11,993	10,718	24,723	27,678
Spruce	15,617	13,163	34,645	28,225
Balsam fir	7,656	7,728	12,239	15,329
Tamarack	941	2,503	1,999	5,237
Northern white-cedar	1,452	1,495	3,318	4,948
Other softwoods	—	—	—	—
Total softwoods	40,652	38,803	93,722	93,268
Hardwoods:				
White oak	12	10	42	10
Red oak	14	113	72	160
Yellow birch	315	3	1,350	14
Hard maple	82	28	163	39
Soft maple	26	77	28	69
Ash	237	302	723	683
Paper birch	1,200	3,253	4,259	6,582
Aspen	20,141	33,351	36,438	75,259
Basswood	56	48	305	152
Elm	51	207	231	618
Other hardwoods	807	1,053	980	1,172
Total hardwoods	22,941	38,445	44,591	84,758
All species	63,593	77,248	138,313	178,026

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 estimates due to changes in survey procedures and definitions.

[2]International ¼-inch rule.

Table 42.—*Timber removals from growing stock on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	1,711	10	411	277	387	626
Red pine	1,485	64	107	490	160	664
Jack Pine	10,718	227	332	1,532	2,262	6,365
White spruce	2,888	11	344	705	853	975
Black spruce	10,275	22	412	5,683	1,283	2,875
Balsam fir	7,728	86	397	3,730	1,002	2,513
Tamarack	2,503	22	1	1,930	6	544
Northern white-cedar	1,495	48	57	1,076	88	226
Other softwoods	—	—	—	—	—	—
Total softwoods	38,803	490	2,061	15,423	6,041	14,788
Hardwoods:						
Select white oak	10	—	—	2	—	8
Select red oak	113	47	8	53	—	5
Other red oak	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	3	—	—	—	—	3
Hard maple	28	4	2	6	1	15
Soft maple	77	—	—	9	1	67
Ash	302	16	19	105	26	136
Balsam poplar	1,044	3	1	638	3	399
Paper birch	3,253	302	243	482	947	1,279
Bigtooth aspen	665	29	1	45	9	581
Quaking aspen	32,686	1,446	1,802	10,988	1,598	16,852
Basswood	48	—	—	32	1	15
Elm	207	3	6	167	1	30
Other hardwoods	9	—	—	1	—	8
Total hardwoods	38,445	1,850	2,082	12,528	2,587	19,398
All species	77,248	2,340	4,143	27,951	8,628	34,186

Table 43.—*Timber removals from sawtimber on commercial forest land by species and county, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	All counties	Carlton	Cook	Koochiching	Lake	St. Louis
Softwoods:						
White pine	7,641	54	2,293	773	2,157	2,364
Red pine	4,210	217	255	925	557	2,256
Jack pine	27,678	672	788	3,269	6,430	16,519
White spruce	6,368	23	867	1,524	1,819	2,135
Black spruce	21,857	38	1,008	12,032	2,746	6,033
Balsam fir	15,329	170	806	7,630	2,177	4,546
Tamarack	5,237	45	1	4,016	12	1,163
Northern white-cedar	4,948	44	222	3,880	324	478
Other softwoods	—	—	—	—	—	—
Total softwoods	93,268	1,263	6,240	34,049	16,222	35,494
Hardwoods:						
Select white oak	10	1	1	2	—	6
Select red oak	160	112	6	33	1	8
Other red oak	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	14	—	—	—	—	14
Hard maple	39	8	3	5	2	21
Soft maple	69	3	—	7	1	58
Ash	683	27	54	348	88	166
Balsam poplar	1,165	2	1	903	2	257
Paper birch	6,582	281	542	643	3,864	1,252
Bigtooth aspen	1,472	69	1	85	22	1,295
Quaking aspen	73,787	3,448	4,653	25,140	3,882	36,664
Basswood	152	—	—	136	1	15
Elm	618	12	4	559	1	42
Other hardwoods	7	—	—	1	—	6
Total hardwoods	84,758	3,963	5,265	27,862	7,864	39,804
All species	178,026	5,226	11,505	61,911	24,086	75,298

[1]International ¼-inch rule.

Table 44.—*Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Aspen-Birch Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other softwoods	Aspen	Other hardwoods	All species	Jack pine	Spruce	Other softwoods	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1]					
Roundwood products:												
Pulpwood	54,803	7,620	11,495	9,008	24,710	1,970	119,715	15,352	25,711	19,940	57,496	1,216
Sawlogs	7,940	2,339	315	2,428	2,384	474	38,649	11,663	1,571	13,140	9,742	2,533
Fuelwood	1,115	22	2	39	607	445	1,555	30	6	54	842	623
Posts	843	358	—	485	(2)	—	362	154	—	207	1	—
Veneer logs	80	—	—	—	63	17	526	—	—	—	406	120
Poles	238	79	—	159	—	—	683	227	—	456	—	—
Other[3]	1,461	2	—	97	737	625	7,210	9	—	537	3,154	3,510
All products	66,480	10,420	11,812	12,216	28,501	3,531	168,700	27,435	27,288	34,334	71,641	8,002
Logging residue:	2,026	202	208	253	1,156	207	1,636	103	7	244	815	467
Other removals:	8,742	96	1,143	2,453	3,694	1,356	7,690	140	930	2,787	2,803	1,030
Total removals:	77,248	10,718	13,163	14,922	33,351	5,094	178,026	27,678	28,225	37,365	75,259	9,499

[1]International ¼-inch rule.
[2]Less than 500 cubic feet.
[3]Includes match bolts, particleboard bolts, shavings bolts, pilings, lath bolts, etc.

Table 45.—*Timber removals from growing stock by ownership class and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
Federal:			
National Forest	10,633	6,063	4,570
Other	960	435	525
State	16,927	10,195	6,732
County	8,924	2,549	6,375
Private:			
Forest industry	10,616	5,104	5,512
Farm and other	29,188	14,457	14,731
All owners	77,248	38,803	38,445

Table 46.—*Timber removals from sawtimber by ownership class and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Ownership class	All species	Softwoods	Hardwoods
Federal:			
National forest	26,767	15,899	10,868
Other	2,707	1,237	1,470
State	43,933	27,421	16,512
County	20,867	5,916	14,951
Private:			
Forest industry	23,580	11,552	12,028
Farmer and other	60,172	31,243	28,929
All owners	178,026	93,268	84,758

[1]International ¼-inch rule.

Table 47.—*Annual mortality of growing stock on commercial forest land by species and cause, Aspen-Birch Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	Cause											
	All causes	Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other	Logging	Timber stand improvement	Land clearing	Conversion
Softwoods:												
White pine	634	—	545	—	27	27	—	35	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	1,563	—	1,285	—	31	222	—	25	—	—	—	—
White spruce	953	101	696	—	—	156	—	—	—	—	—	—
Black spruce	3,438	173	2,246	—	56	515	—	448	—	—	—	—
Balsam fir	12,429	4,887	5,490	—	—	719	—	1,333	—	—	—	—
Tamarack	2,736	322	519	—	—	—	—	1,895	—	—	—	—
Northern white-cedar	1,176	—	251	—	—	557	—	312	56	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	22,929	5,483	11,032	—	114	2,196	—	4,048	56	—	—	—
Hardwoods:												
Select white oaks	—	—	—	—	—	—	—	—	—	—	—	—
Select red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	87	—	87	—	—	—	—	—	—	—	—	—
Hard maple	626	—	362	—	—	—	—	—	—	264	—	—
Soft maple	6	—	6	—	—	—	—	—	—	—	—	—
Ash	1,576	—	455	—	—	408	—	403	—	310	—	—
Balsam poplar	4,545	—	1,456	—	784	1,333	—	972	—	—	—	—
Paper birch	2,562	—	1,931	120	—	77	—	434	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	22,852	—	17,328	—	1,148	2,329	—	1,770	277	—	—	—
Basswood	—	—	—	—	—	—	—	—	—	—	—	—
Elm	313	—	184	—	—	—	—	—	—	129	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	32,567	—	21,809	120	1,932	4,147	—	3,579	277	703	—	—
All species	55,496	5,483	32,841	120	2,046	6,343	—	7,627	333	703	—	—

Table 48.—*Annual mortality of sawtimber on commercial forest land by species and cause, Aspen-Birch Unit, Minnesota, 1976*
(In thousand board feet[1])

Species	Cause											
	All causes	Insects	Disease	Fire	Animals	Weather	Suppression	Unknown and other	Logging	Timber stand improvement	Land clearing	Conversion
Softwoods:												
White pine	1,263	—	737	—	193	171	—	162	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	1,306	—	944	—	—	362	—	—	—	—	—	—
White spruce	2,867	237	1,710	—	—	920	—	—	—	—	—	—
Black spruce	1,304	—	670	—	228	406	—	—	—	—	—	—
Balsam fir	12,787	6,482	3,377	—	—	1,117	—	1,811	—	—	—	—
Tamarack	2,835	—	—	—	—	—	—	2,835	—	—	—	—
Northern white-cedar	4,616	—	717	—	—	2,229	—	1,294	376	—	—	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	26,978	6,719	8,155	—	421	5,205	—	6,102	376	—	—	—
Hardwoods:												
Select white oaks	—	—	—	—	—	—	—	—	—	—	—	—
Select red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	27	—	27	—	—	—	—	—	—	—	—	—
Hard maple	—	—	—	—	—	—	—	—	—	—	—	—
Soft maple	8	—	8	—	—	—	—	—	—	—	—	—
Ash	2,985	—	1,469	—	—	—	—	—	—	1,516	—	—
Balsam poplar	1,999	—	10	—	—	1,989	—	—	—	—	—	—
Paper birch	2,397	—	1,200	—	—	—	—	1,197	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	30,113	—	19,687	—	1,322	4,402	—	3,531	1,171	—	—	—
Basswood	—	—	—	—	—	—	—	—	—	—	—	—
Elm	1,349	—	829	—	—	—	—	—	—	520	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	38,878	—	23,230	—	1,322	6,391	—	4,728	1,171	2,036	—	—
All species	65,856	6,719	31,385	—	1,743	11,596	—	10,830	1,547	2,036	—	—

[1]International ¼-inch rule.

Table 49.—*Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National forest	9,649	6,885	2,764	1,556	928	628
Bureau of land mgmt.	—	—	—	—	—	—
Indian	686	456	230	—	—	—
Miscellaneous Federal	276	53	223	—	—	—
State	10,341	5,992	4,349	12,564	8,457	4,107
County and municipal	11,099	2,570	8,529	15,339	3,911	11,428
Forest industry	7,797	3,114	4,683	10,503	5,883	4,620
Farmer	5,544	742	4,802	7,428	1,486	5,942
Farmer-owned leased	—	—	—	—	—	—
Misc. private-corp.	4,256	1,341	2,915	10,891	3,441	7,450
Misc. private-individual	5,654	1,776	3,878	7,575	2,872	4,703
Misc. priv.-corp., leased	194	—	194	—	—	—
Misc. priv.-ind., leased	—	—	—	—	—	—
All owners	55,496	22,929	32,567	65,856	26,978	38,878

[1]International ¼-inch rule.

Table 50.— *Output of timber products by source of material and softwoods and hardwoods, Aspen-Birch Unit, Minnesota, 1975*

Product and species group	Standard unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
Pulpwood:	Std. cords								
Softwood		411,935	32,540	356,019	28,123	20,445	1,615	35,471	2,802
Hardwood		395,215	31,216	337,785	26,680	46,806	3,697	10,624	839
Total		807,150	63,756	693,804	54,803	67,251	5,312	46,095	3,641
Fuelwood:	Std. cords								
Softwood		21,476	1,492	973	63	1,190	77	19,313	1,352
Hardwood		37,309	2,598	15,114	1,052	19,826	1,380	2,369	166
Total		58,785	4,090	16,087	1,115	21,016	1,457	21,682	1,518
Posts:	Thousand pcs.								
Softwood		1,291	1,039	1,047	843	244	196	—	—
Hardwood		1	(1)	1	(1)	—	(1)	—	—
Total		1,292	1,039	1,048	843	244	196	—	—
Veneer logs	Thousand bd. ft.[2]								
Softwood		—	—	—	—	—	—	—	—
Hardwood		553	88	503	80	50	8	—	—
Total		553	88	503	80	50	8	—	—
Poles:	Pieces								
Softwood		40,193	241	39,693	238	500	3	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		40,193	241	39,693	238	500	3	—	—
Saw logs:	Thousand bd. ft.[2]								
Softwood		28,192	5,247	27,305	5,082	887	165	—	—
Hardwood		15,939	2,921	15,595	2,858	344	63	—	—
Total		44,131	8,168	42,900	7,940	1,231	228	—	—
Other[3]	Thousand cu. ft.								
Softwood		177	177	99	99	2	2	76	76
Hardwood		1,434	1,434	1,362	1,362	63	63	9	9
Total		1,611	1,611	1,461	1,461	65	65	85	85
All products:	Thousand cu. ft.								
Softwood		40,736	40,736	34,448	34,448	2,058	2,058	4,230	4,230
Hardwood		38,257	38,257	32,032	32,032	5,211	5,211	1,014	1,014
Total		78,993	78,993	66,480	66,480	7,269	7,269	5,244	5,244

[1]Less than 500 cubic feet.

[2]International ¼-inch rule.

[3]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.— *Forest products harvested by ownership class and product, Aspen-Birch Unit, Minnesota, 1975*

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*Thousand board feet*[2]	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
Federal:						
National Forest:						
Softwoods	64,954	5,526	288	—	—	13
Hardwoods	44,390	1,981	1,580	—	—	399
Other Federal:						
Softwoods	3,329	678	—	9	—	1
Hardwoods	3,786	1,046	960	—	—	—
Total	116,459	9,231	2,828	9	—	413
State:						
Softwoods	97,163	11,515	—	375	16,677	10
Hardwoods	66,299	6,408	1,253	—	—	152
Total	163,462	17,923	1,253	375	16,677	162
County:						
Softwoods	29,705	1,064	—	48	485	3
Hardwoods	77,220	1,897	3,318	—	—	272
Total	106,925	2,961	3,318	48	485	275
Private:						
Forest industry:						
Softwoods	58,983	1,917	82	225	—	—
Hardwoods	65,300	522	72	—	—	241
Farm and other:						
Softwoods	122,330	7,492	1,793	634	23,031	74
Hardwoods	127,596	4,085	27,757	1	—	449
Total	374,209	14,016	29,704	860	23,031	764
All owners:						
Softwoods	376,464	28,192	2,163	1,291	40,193	101
Hardwoods	384,591	15,939	34,940	1	—	1,513
Total	761,055	44,131	37,103	1,292	40,193	1,614

[1]Standard cords, rough wood basis.
[2]International ¼-inch rule.

Table 52.—*Volume of primary plant residue by kind of material and type of use, Aspen-Birch Unit, Minnesota, 1975*

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	651.1	413.9	595.1	406.9	56.0	7.0	—	4.2
Industrial fuel	1,292.9	62.0	800.7	19.8	492.2	42.2	547.3	297.0
Domestic fuel	59.0	103.8	57.1	98.4	1.9	5.4	27.7	62.2
Miscellaneous[5]	75.5	8.8	62.5	—	13.0	8.8	1.3	.2
Not used[6]	478.4	471.8	99.7	144.5	378.7	327.3	507.9	364.8
Total	2,556.9	1,060.3	1,615.1	669.6	941.8	390.7	1,084.2	728.4

[1]Suitable for chipping such as slabs, edging, veneer cores etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Does not include bark disposal at pulpmills.
[4]For manufacture of pulp, hardboard or roofing felt.
[5]Lifestock bedding, mulch, small dimension, and specialty items.
[6]Includes residue burned as waste.

Table 53.—*Timber products output from roundwood by species and product, Aspen-Birch Unit, Minnesota, 1975*

Species	Saw logs		Veneer logs		Pulpwood		Fuelwood		Poles		Posts		Other Products	All Products
	Thousand board feet[1]	Thousand cubic feet[2]	Thousand board feet[1]	Thousand cubic feet[2]	Cords	Thousand cubic feet[2]	Cords	Thousand cubic feet[2]	Pieces	Thousand cubic feet[2]	Thousand pieces	Thousand cubic feet[2]	Thousand cubic feet[2]	Thousand cubic feet[2]
Softwoods:														
White pine	6,512	1,124	—	—	6,228	492	34	—	—	—	—	—	—	1,616
Red pine	2,065	357	—	—	6,776	534	183	10	26,812	161	332	267	5	1,334
Jack pine	12,673	2,434	—	—	103,519	8,178	735	48	13,381	80	551	442	2	11,184
Spruce	1,707	328	—	—	152,863	12,075	125	5	—	—	—	—	—	12,408
Balsam fir	1,123	215	—	—	76,451	6,040	1,086	77	—	—	—	—	—	6,332
Tamarack	3	—	—	—	30,627	2,419	—	—	—	—	3	3	—	2,422
Northern white-cedar	4,109	789	—	—	—	—	—	—	—	—	405	327	94	1,210
Total softwoods	28,192	5,247	—	—	376,464	29,738	2,163	140	40,193	241	1,291	1,039	101	36,506
Hardwoods:														
White oak	—	—	—	—	—	—	101	3	—	—	—	—	—	3
Red oak	97	16	1	—	1,069	85	220	12	—	—	—	—	—	113
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	14	2	—	—	—	—	—	—	—	—	—	2
Hard maple	4	1	7	1	41	2	403	26	—	—	—	—	—	30
Soft maple	—	—	11	1	60	3	—	—	—	—	—	—	—	4
Ash	484	83	—	—	—	—	2,302	161	—	—	—	—	—	244
Balsam poplar	583	103	—	—	9,808	775	—	—	—	—	—	—	—	878
Paper birch	988	172	85	13	15,798	1,248	11,790	824	—	—	—	—	637	2,894
Aspen	13,104	2,428	428	70	357,123	28,209	20,022	1,404	—	—	1	—	788	32,899
Basswood	133	23	1	—	—	—	34	—	—	—	—	—	—	23
Elm	546	95	6	1	692	55	51	2	—	—	—	—	—	153
Other hardwoods	—	—	—	—	—	—	17	—	—	—	—	—	—	17
Total hardwoods	15,939	2,921	553	88	384,591	30,377	34,940	2,432	—	—	1	—	1,425	37,243
All species	44,131	8,168	553	88	761,055	60,115	37,103	2,572	40,193	241	1,292	1,039	1,526	73,749

[1]International ¼-inch rule.
[2]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.

Table 54.—*Sampling errors[1] for estimates smaller than unit totals of volume, net growth, removals, and area of commercial forest land, Aspen-Birch Unit, Minnesota, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	Million cubic feet			Million board feet[2]		
1	569.7	17,501.7'	1,071.6	1,605.3	103,144.3	6,179.7	2,306.9
2	142.4	4,375.4	267.9	401.3	25,786.1	1,545.0	576.7
3	63.3	1,944.6	119.1	178.4	11,460.5	686.6	256.3
4	35.6	1,093.9	67.0	100.3	6,446.5	386.3	144.2
5	22.8	700.1	42.8	64.2	4,125.8	247.2	92.3
10	5.7	175.0	10.7	16.1	1,031.4	61.8	23.1
15	2.5	77.8	4.8	7.1	458.4	27.5	10.3
20	1.4	43.8	2.7	4.0	257.9	15.5	5.8
25	0.9	28.0	1.7	2.6	165.0	9.9	3.7
50	0.2	7.0	0.4	0.6	41.3	2.5	0.9
100	0.1	1.8	0.1	0.2	10.3	0.6	0.2

[1]At the 67 percent probability level.
[2]International ¼-inch rule.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980-668-248/150 REG.#6

Spencer, John S., Jr., and Arnold J. Ostrom.

1979. Timber resource of Minnesota's Aspen-Birch Unit, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-43, 52 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

The fourth inventory of Minnesota's Aspen-Birch Unit shows solid gains in growing-stock and sawtimber volumes between 1962 and 1977, but a 13-percent decline in commercial forest area. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

OXFORD: 905(776). KEY WORDS: timber volume, growth, utilization, forest area.

Spencer, John S., Jr., and Arnold J. Ostrom.

1979. Timber resource of Minnesota's Aspen-Birch Unit, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-43, 52 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

The fourth inventory of Minnesota's Aspen-Birch Unit shows solid gains in growing-stock and sawtimber volumes between 1962 and 1977, but a 13-percent decline in commercial forest area. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

OXFORD: 905(776). KEY WORDS: timber volume, growth, utilization, forest area.

Plant a tree...trees give oxygen.

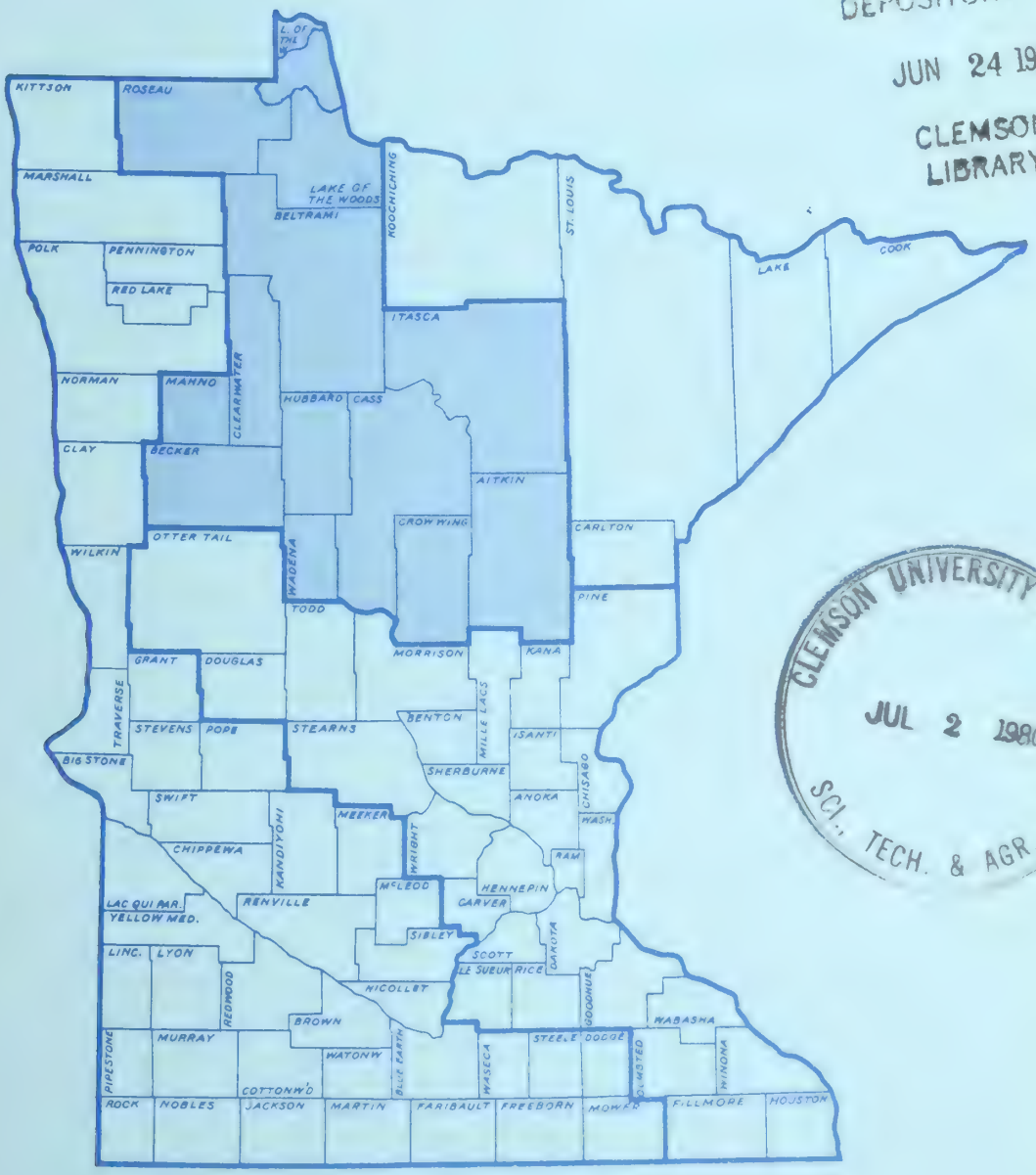
Timber resource of Minnesota's northern pine unit, 1977.

Pamela J. Jakes and Gerhard K. Raile

GOVT. DOCUMENTS
DEPOSITORY ITEM

JUN 24 1980

CLEMSON
LIBRARY



CLEMSON UNIVERSITY LIBRARY
JUL 2 1980
SCI., TECH. & AGR. DIV.

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication May 18, 1979

1980

CONTENTS

	Page
Highlights	1
Tables	3
Principal Tree Species Groups in the Northern Pine Unit	4
Appendix	5
Accuracy of Survey	5
Survey Procedures	6
Comparing Surveys	6
Metric Equivalents	7
Definition of Terms	7

FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are also available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Northern Pine Unit survey were furnished by the Chippewa National Forest, Minnesota Department of Natural Resources, and the U.S. Department of the Interior, Bureau of Indian Affairs.

TIMBER RESOURCE OF MINNESOTA'S NORTHERN PINE UNIT, 1977

Pamela J. Jakes, *Associate Resource Analyst,*
and **Gerhard K. Raile,** *Associate Mensurationist*

HIGHLIGHTS

Forest Area

- In 1977, 59 percent (6.5 million acres) of the Unit's total land area was classified as forest land; in 1962[1], 63 percent (7.0 million acres) of the Unit's total land area was classified as forest land.
- The area of commercial forest land declined 4 percent between surveys, from 6.0 million acres in 1962 to 5.8 million acres in 1977.
- Fifty-eight percent of the Unit's commercial forest land is publicly owned; the State of Minnesota is the largest public owner (1.2 million acres).
- Farmers own 1.3 million acres of commercial forest land in the Unit, the most of any ownership class (fig. 1).
- The dominant forest type in the Unit is aspen, covering 44 percent of the commercial forest land.
- Poletimber-size stands constitute the largest stand-size class, 53 percent of the commercial forest land is in this class.
- Eleven percent of the Unit's forest land is unproductive.

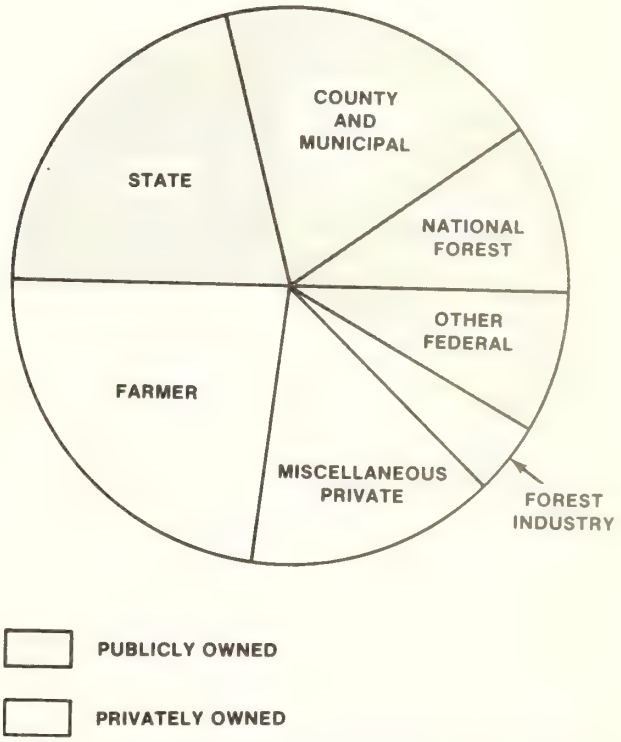


Figure 1.—*Distribution of commercial forest land by ownership class, Northern Pine Unit, Minnesota, 1977.*

Timber Volume

- The net volume of timber on commercial forest land is 5,804 million cubic feet— 87 percent in growing-stock trees, 12 percent in cull trees, and 1 percent in salvable dead trees.
- Growing-stock volume is 5,023 million cubic feet. Sawtimber volume is 10,621 million board feet.

[1]*1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix.)*

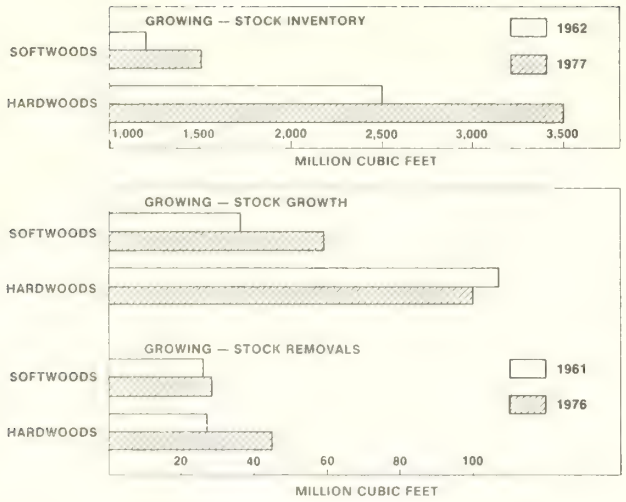


Figure 2.— *Growing-stock inventory, net annual growth, and removals, by softwoods and hardwoods, Northern Pine Unit, Minnesota, 1962 and 1977.*

• Growing-stock volume increased 35 percent between 1962 and 1977 (fig. 2).

• Seventy percent (3,513 million cubic feet) of the growing-stock volume is in hardwood species and 30 percent (1,509 million cubic feet) is in softwoods.

• Sixty-one percent (6,439 million board feet) of the sawtimber volume is in hardwood species and 39 percent (4,182 million board feet) is in softwoods.

• The growing-stock volume per acre of commercial forest land ranges, by county, from a high of 1,013 cubic feet per acre in Itasca County to a low of 518 cubic feet per acre in Roseau County.

• Growing-stock volume is concentrated (47 percent of total volume) in the 8-inch and 10-inch diameter classes.

• Farmers own 22 percent (1,116 million cubic feet) of the Unit's growing-stock volume; county and municipal agencies own 21 percent (1,030 million cubic feet), and the State of Minnesota owns 18 percent (905 million cubic feet).

Stand Condition

• Net annual growth was 159.8 million cubic feet in 1976 or about 28 cubic feet per acre per year.

• The growth rate for softwoods is 3.9 percent of inventory compared to a 2.9 percent growth rate for hardwoods; the growth rate for all tree species is highest on Bureau of Land Management and miscellaneous Federal commercial forest land (4.8 percent of inventory and 4.1 percent of inventory, respectively).

• The mortality rate for softwoods (0.7 percent of inventory) is less than half the mortality rate for hardwoods (1.5 percent).

• Seventy-five percent of the forest stands are more than 30 years old, and 41 percent are more than 50 years old.

Timber Use

• Timber removals in 1976[2] totaled 73.4 million cubic feet— 44.9 million cubic feet from hardwoods and 28.5 million cubic feet from softwoods.

• Three-tenths of total removals came from Itasca County.

• Of the 73.4 million cubic feet of removals, 54.4 million cubic feet were roundwood products, 17.1 million cubic feet were other removals, and 2.0 million cubic feet were logging residue.

• Forty-six percent of removals came from farmer and miscellaneous privately owned land, 22 percent from State-owned land, and 13 percent from county-owned land.

• Timber products output totaled 68.5 million cubic feet in 1975— 59 percent pulpwood, 21 percent saw logs, 13 percent fuelwood, and the remaining 7 percent made up of posts, veneer logs, poles, and other products.

• The volume of primary plant wood residue was 5.4 million cubic feet.

---

[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included in 1976 removals.*

TABLES

Area

1. Area of land by land class, 1962 and 1977.
2. Area of land by land class and county.
3. Area of commercial forest land by county and ownership class.
4. Area of commercial forest land by county and forest type.
5. Area of commercial forest land by county and site index class.
6. Area of commercial forest land by county and stand-size class.
7. Area of commercial forest land by site and ownership class.
8. Area of commercial forest land by forest type and ownership class.
9. Area of commercial forest land by forest type and stand-age class.
10. Area of commercial forest land by forest type, stand-size, and site class.
11. Area of noncommercial forest land by ownership class.
12. Area of noncommercial forest land by forest type.

Number of Trees

13. Number of all live trees on commercial forest land by species and diameter class.
14. Number of growing-stock trees on commercial forest land by species and diameter class.
15. Number of short-log trees on commercial forest land by species and diameter class.

Volume

16. Net volume of growing stock and sawtimber on commercial forest land by species, 1962 and 1977.
17. Cubic foot volume in all live trees on commercial forest land by species and diameter class.
18. Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods.
19. Net volume of growing stock on commercial forest land by species and county.
20. Net volume of sawtimber on commercial forest land by species and county.
21. Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species.
22. Net volume of growing stock on commercial forest land by species and diameter class.
23. Net volume of sawtimber on commercial forest land by species and diameter class.
24. Net volume of growing stock on commercial forest land by species and forest type.
25. Net volume of sawtimber on commercial forest land by species and forest type.
26. Net volume of growing stock on commercial forest land by species and ownership class.
27. Net volume of sawtimber on commercial forest land by species and ownership class.
28. Net volume of growing stock on commercial forest land by forest type and stand-age class.
29. Net volume of sawtimber on commercial forest land by forest type and stand-age class.
30. Net volume of short-log trees on commercial forest land by species and diameter class (in cubic feet).
31. Net volume of short-log trees on commercial forest land by species and diameter class (in board feet).

Growth

32. Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, 1961 and 1976.
33. Net annual growth of growing stock on commercial forest land by species and county.
34. Net annual growth of sawtimber on commercial forest land by species and county.
35. Net annual growth of growing stock on commercial forest land by species and ownership class.

36. Net annual growth of sawtimber on commercial forest land by species and ownership class.
37. Net annual growth of growing stock on commercial forest land by species and forest type.
38. Net annual growth of sawtimber on commercial forest land by species and forest type.
39. Net annual growth of growing stock on commercial forest land by forest type and stand-age.
40. Net annual growth of sawtimber on commercial forest land by forest type and stand-age.

Timber removals

41. Timber removals from growing stock and sawtimber on commercial forest land by species, 1962 and 1976.
42. Timber removals from growing stock on commercial forest land by species and county.
43. Timber removals from sawtimber on commercial forest land by species and county.
44. Timber removals from growing stock and sawtimber on commercial forest land by item and species group.
45. Timber removals from growing stock by ownership class and softwoods and hardwoods.
46. Timber removals from sawtimber by ownership class and softwood and hardwoods.

Mortality

47. Annual mortality of growing stock on commercial forest land by species and cause.
48. Annual mortality of sawtimber on commercial forest land by species and cause.
49. Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods.

Utilization

50. Output of timber products by source of material and softwoods and hardwoods.
51. Forest products harvested by ownership class and product.
52. Volume of primary plant residue by kind of material and type of use.
53. Timber products output from roundwood, by species and product.

Text table

54. Sampling errors for estimates smaller than unit totals of volume, net growth, removals, and area of commercial forest land.

PRINCIPAL TREE SPECIES IN MINNESOTA'S NORTHERN PINE UNIT[3]

SOFTWOOD SPECIES

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*

Other softwoods:
Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES

White oaks:
White oak ..... *Quercus alba*
Bur oak ..... *Quercus macrocarpa*

Select red oak:
Northern red oak ..... *Quercus rubra*

Other red oaks:
Northern pin oak ..... *Quercus ellipsoidalis*

Hickories:
Butternut hickory ..... *Carya cordiformis*
Yellow birch ..... *Betula alleghaniensis*

---

[3]*The common and scientific names are based on Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

Hard maples:
- Sugar maple .....*Acer saccharum*

Soft maples:
- Red maple .....*Acer rubrum*
- Silver maple .....*Acer saccharinum*

Ashes:
- White ash .....*Fraxinus americana*
- Black ash .....*Fraxinus nigra*
- Green ash .....*Fraxinus pennsylvanica*

Balsam poplar .....*Populus balsamifera*
Paper birch .....*Betula papyrifera*
Bigtooth aspen .....*Populus grandidentata*
Quaking aspen .....*Populus tremuloides*
Basswood .....*Tilia americana*

Elms:
- American elm .....*Ulmus americana*
- Slippery elm .....*Ulmus rubra*
- Rock elm .....*Ulmus thomasii*

Select hardwoods:
- Butternut .....*Juglans cinerea*
- Black cherry .....*Prunus serotina*

Other hardwoods:
- Boxelder .....*Acer negundo*
- Eastern cottonwood .....*Populus deltoides*
- Black willow .....*Salix nigra*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Northern Pine Unit in 1977, 5,758.4 thousand acres, has a sampling error of ±0.69 percent (±39.7 thousand acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would fall between 5,798.1 and 5,718.7 thousand acres (5,758.4 ±39.7).

Sampling errors were calculated separately for National Forest land and other land, reflecting the higher sampling intensity on other land. For example, the sampling error for growing-stock inventory on National Forest land is ±7.47, but on other land it is ±1.18.

The following sampling errors are the combined sampling errors for total estimated volume, net growth, and removals, and area of commercial forest land during the 1977 Northern Pine Unit survey

Item	Northern pine unit totals	Sampling error (percent)	
Growing stock:			
Volume	5,022.9	MM cubic feet	1.40
Growth	159.8	MM cubic feet	1.80
Removals	73.4	MM cubic feet	5.34
Sawtimber:			
Volume	10,620.7	MM board feet	2.94
Growth	488.1	MM board feet	2.95
Removal	182.4	MM board feet	4.30
Commercial forest land:	5,758.4	M acres	0.69

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURES

The major steps in the survey of the Northern Pine Unit were as follows:

1. A total of 72,591 1-acre points were distributed systematically across aerial photos of the entire area, except the Chippewa National Forest. To make a preliminary estimate of forest area, these points were classified as either forest land (31,050), unproductive forest land (2,223), nonforest land (38,702), or questionable (616). Next, all 31,050 of the forest points, 298 of the unproductive forest points, 47 of the nonforest points with trees, and all 616 of the questionable points were stereo-classified as to forest type, stand-size class, and density. Then, 4,202 points classed as forest, 298 points classed as unproductive, and 81 points classed as questionable were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 3,718 commercial forest locations, 10-point variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated using the Forest Resources Evaluation Program (FREP)[4], which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

3. Area statistics for the Chippewa National Forest were prepared by the Forest Timber Management staff from compartment examination records. In 1975, the Forest conducted its own forest inventory using 10-point variable-radius plots established by Forest personnel under the direction of the North Central Station. Data from these plots were used as input for FREP, which, was used to update volumes to 1977. The updated Chippewa National Forest data were approved by the Forest and merged with Survey data from non-National Forest commercial forest land to estimate volume, growth, and mortality for the Unit.

4. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

5. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

6. Field data were sent to St. Paul, Minnesota, for compilation.

COMPARING MINNESOTA'S FOURTH SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

[4] *For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. NC-49, 96 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

In Minnesota's Northern Pine Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys. Then, a portion of the 1962 commercial forest area was withdrawn and added to unproductive forest (noncommercial) and to nonforest to allow for changes in the method of determining these land uses. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area. However, because the 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes. Volume adjustments were made by estimating inventory, growth, mortality, and removals on the unproductive forest and nonforest lands originally classed as commercial forest in 1962, and subtracting these volumes from the original State 1962 estimates.

A test was made to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so that changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commerical forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys reflected actual change and not merely a change in the volume equations used on each occasion.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals and are trend level removals "Other" removals from transfer of commercial forest land to productive-reserved are not included. Previously published 1960 estimates are of timber cut only and do not include "other" removals. TRAS generated an estimate of 1962 "other" removals to provide the adjusted 1962 total removals.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-Use Classes

Gross area.— The entire area of land and water as determined by the Bureau of Census, 1960.

Land area.— The area of dry land and land temporarily or partially covered by water such as

marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than 1/8-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.— Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.— Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.— (a) Unproductive— forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved— forest land withdrawn from commercial timber use through statute or administrative regulation or exclusively used for Christmas tree production.

Nonforest land.— Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased.—Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.—Land owned by a private individual but leased to another party.

Tree Classes

All live trees.— Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.— All live trees of commercial species except rough and rotten trees.

Desirable trees.— Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.— Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.— Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.— Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.— Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.— Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more than 6 inches and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.— Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.— Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).— Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.— Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.— Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.— Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands.— Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.— Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-Size Classes

Stand.— A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.— Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.— Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.— Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.— Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.— An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.— A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.— Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.— The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are

Jack pine.— Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.— Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.— Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.— Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.— Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.— Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of the live-tree stocking, with black spruce the most common.

Northern white-cedar.— Forests in which swamp conifers comprise a plurality of the live-tree stocking, with northern white-cedar the most common.

Tamarack.— Forests in which swamp conifers comprise a plurality of live-tree stocking, with tamarack the most common.

Oak.— Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.— Forests in which lowland elm, ash, cottonwood and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.— Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.— Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.— Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.— Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.— The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.— Net volume of the saw log portion of live sawtimber trees in board

feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.— That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.— Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year,

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

The annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year, and

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Timber Removals

Timber removals from growing stock.— The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees

removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change— examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.— The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.— All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.— Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.— Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Northern Pine Unit, Minnesota, 1962 and 1977*
(In thousand acres)

Land class	[1]1962	1977
Commercial forest land:		
Jack pine	453.1	327.4
Red pine	149.5	121.9
White pine	40.2	24.8
Balsam fir	231.0	225.6
White spruce	5.6	19.1
Black spruce	303.7	278.2
Northern white-cedar	120.7	180.8
Tamarack	250.1	276.0
Oak	360.9	247.4
Elm-ash-cottonwood	397.4	309.8
Maple-basswood	421.0	466.4
Aspen	2,360.8	2,541.7
Paper birch	283.4	371.2
Balsam poplar	240.3	297.5
Nonstocked	407.3	70.6
Subtotal	6,025.0	5,758.4
Noncommercial forest land:		
Unproductive	950.1	706.9
Productive-reserved	29.1	46.9
Subtotal	979.2	753.8
Nonforest land:	4,133.1	4,542.9
Total	11,137.3	11,055.1

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 areas because of changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Land class	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Forest land:													
Commercial	5,758.4	672.5	313.9	794.6	858.6	301.7	371.9	398.0	1,281.0	360.6	106.4	191.9	107.3
Productive-reserved	46.9	15.0	3.1	0.5	1.3	19.6	—	4.0	1.5	—	—	1.9	—
Unproductive	706.9	75.1	5.8	248.9	23.5	12.4	8.8	1.2	49.1	235.5	1.4	38.8	6.4
Total forest	6,512.2	762.6	322.8	1,044.0	883.4	333.7	380.7	403.2	1,331.6	596.1	107.8	232.6	113.7
Nonforest with trees:													
Cropland with trees	20.8	1.5	6.3	1.7	—	—	—	1.8	1.6	1.6	3.2	1.6	1.5
Improved pasture with trees	29.4	4.7	4.1	2.7	5.5	2.9	—	—	3.2	—	—	3.3	3.0
Wooded strips	24.6	4.0	2.9	1.4	2.4	4.2	2.3	—	5.8	—	—	1.6	—
Idle farmland with trees	1.4	—	—	1.4	—	—	—	—	—	—	—	—	—
Windbreaks	12.3	—	1.1	1.6	—	5.0	—	1.6	—	1.2	—	1.8	—
Wooded pasture	22.1	1.3	2.7	5.6	1.7	1.6	4.8	3.1	1.3	—	—	—	—
Total nonforest with trees	110.6	11.5	17.1	14.4	9.6	13.7	7.1	6.5	11.9	2.8	3.2	8.3	4.5
Nonforest without trees:													
Cropland without trees	2,007.2	96.6	323.4	149.8	101.1	148.4	68.5	131.6	74.2	84.0	173.6	527.2	128.8
Improved pasture without trees	527.3	45.0	56.2	76.2	87.4	13.1	46.3	4.2	37.8	15.4	36.4	77.3	42.0
Idle farmland without trees	22.3	1.4	1.4	7.3	—	3.0	1.7	—	3.1	—	—	4.4	—
Marsh	1,449.9	218.0	76.6	277.7	155.1	102.3	76.1	26.0	123.7	138.9	26.6	190.7	38.2
Other farm-farmstead	43.3	1.4	6.8	4.2	4.3	2.8	1.4	—	9.8	1.4	2.8	5.6	2.8
Urban and other	350.2	31.6	32.0	30.6	37.9	18.2	47.7	22.3	82.1	0.2	8.2	26.7	12.7
Noncensus water	32.1	1.6	3.7	—	—	4.7	7.0	2.4	11.1	—	1.6	—	—
Total nonforest without trees	4,432.3	395.6	490.1	545.8	385.8	292.5	248.7	186.5	341.8	239.9	249.2	831.9	224.5
Total nonforest	4,542.9	407.1	507.2	560.2	395.4	306.2	255.8	193.0	353.7	242.7	252.4	840.2	229.0
Total land area[1]	11,055.1	1,169.7	830.0	1,604.2	1,278.8	639.9	636.5	596.2	1,685.3	838.8	360.2	1,072.8	342.7
Census water	1,437.7	103.3	84.6	351.0	244.4	19.3	95.0	41.2	170.7	308.7	15.5	0.5	3.5
Total gross area	12,492.8	1,273.0	914.6	1,955.2	1,523.2	659.2	731.5	637.4	1,856.0	1,147.5	375.7	1,073.3	346.2

[1]U.S. Department of Commerce, Bureau of Census. Area measurement reports, GE-20 No. 1, 22 p., 1970.

Table 3.—*Area of commercial forest land by county and ownership class, Northern Pine Unit, Minnesota, 197*
(In thousand acres)

		Ownership class												
County	All owners	National forest	Bureau of Land Management	Indian	Misc. federal	State	County and municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc priv. indiv. lease
Aitkin	672.5	—	—	—	8.3	217.4	180.0	4.2	180.8	—	5.2	76.6	—	—
Becker	313.9	—	—	3.9	23.3	36.6	64.2	2.6	138.0	—	1.4	41.2	—	2.7
Beltrami	794.6	54.7	—	195.6	—	227.2	133.7	2.5	137.4	—	—	43.5	—	—
Cass	858.6	242.7	—	11.4	—	121.0	211.1	28.1	119.1	—	13.8	111.4	—	—
Clearwater	301.7	—	—	56.4	—	26.2	63.6	5.5	136.1	—	—	13.9	—	—
Crow Wing	371.9	—	—	—	—	16.9	74.3	18.3	68.9	—	35.8	157.7	—	—
Hubbard	398.0	—	1.4	—	—	64.4	128.4	20.9	122.1	—	6.0	54.8	—	—
Itasca	1,281.0	264.9	—	1.5	—	233.6	235.9	131.3	206.9	—	85.3	121.6	—	—
Lake of the Woods	360.6	—	34.4	63.1	2.9	171.9	—	1.6	49.2	—	—	37.5	—	—
Mahnomen	106.4	—	—	28.7	—	21.3	4.2	—	50.8	—	—	1.4	—	—
Roseau	191.9	—	—	4.3	26.0	75.0	1.3	—	61.3	—	4.2	19.8	—	—
Wadena	107.3	—	—	—	—	17.2	—	18.8	51.5	—	2.6	17.2	—	—
All counties	5,758.4	562.3	35.8	364.9	60.5	1,228.7	1,096.7	233.8	1,322.1	—	154.3	696.6	—	2.7

Table 4.—*Area of commercial forest land by county and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

unty	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
kin	672.5	2.5	1.6	1.2	15.2	1.2	50.0	8.2	43.4	15.4	71.2	142.8	253.4	40.2	23.4	2.8
cker	313.9	16.7	2.6	1.1	10.5	—	6.1	—	17.4	29.4	8.8	41.1	151.8	20.3	8.1	—
ltrami	794.6	40.1	15.7	7.1	26.3	4.1	34.5	53.1	63.5	8.6	47.6	40.8	319.3	48.5	70.5	14.9
ss	858.6	55.3	35.4	6.9	19.9	1.4	17.7	25.4	23.4	49.1	36.0	66.1	423.0	80.7	12.8	5.5
earwater	301.7	7.7	4.9	4.4	15.6	—	8.6	4.6	13.4	7.2	9.9	29.6	156.3	15.8	22.0	1.7
ow Wing	371.9	25.4	4.1	—	2.8	—	4.2	1.2	12.0	86.7	18.5	19.6	165.9	29.0	—	2.5
ubbard	398.0	63.5	12.9	1.4	14.1	3.3	5.9	1.4	6.5	17.3	2.5	5.7	224.9	30.2	8.4	—
sca	1,281.0	40.6	39.8	2.7	97.2	4.9	84.7	60.1	43.3	9.9	89.2	96.7	539.7	92.0	56.6	23.6
ke of the Woods	360.6	22.6	1.4	—	16.5	2.7	54.9	21.2	33.6	—	7.8	—	115.1	10.2	57.8	16.8
ahnomen	106.4	1.4	—	—	1.7	1.5	—	—	2.6	9.7	1.7	17.0	64.7	3.0	3.1	—
seau	191.9	15.0	—	—	5.8	—	9.2	5.6	15.0	—	13.9	5.8	85.9	1.3	31.6	2.8
adena	107.3	36.6	3.5	—	—	—	2.4	—	1.9	14.1	2.7	1.2	41.7	—	3.2	—
All counties	5,758.4	327.4	121.9	24.8	225.6	19.1	278.2	180.8	276.0	247.4	309.8	466.4	2,541.7	371.2	297.5	70.6

Table 5.—*Area of commercial forest land by county and site index class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

		Site index class (cubic feet of growth/acre/year)								
ounty	All classes	91+	81-90	71-80	61-70	51-60	41-50	31-40	21-30	11-20
itkin	672.5	4.0	34.6	108.9	165.4	166.2	99.9	58.9	33.5	1.1
ecker	313.9	—	9.3	44.2	91.5	82.2	45.6	38.2	2.9	—
eltrami	794.6	7.1	38.6	127.6	182.5	164.4	101.1	98.5	63.5	11.3
ass	858.6	1.4	70.1	193.5	217.0	196.7	96.6	51.0	27.7	4.6
learwater	301.7	8.4	26.3	40.0	79.9	67.9	45.1	23.2	9.5	1.4
row Wing	371.9	—	15.1	58.8	103.5	116.0	64.8	6.7	7.0	—
ubbard	398.0	—	19.6	58.4	121.9	109.9	63.5	18.6	6.1	—
asca	1,281.0	19.4	159.8	264.1	283.5	212.6	134.5	106.8	83.6	16.7
ake of the Woods	360.6	—	5.4	23.7	51.8	70.3	85.0	61.6	49.5	13.3
lahnomen	106.4	1.4	2.8	25.7	25.8	26.5	16.8	7.4	—	—
oseau	191.9	—	1.3	5.2	33.5	53.8	59.5	29.6	9.0	—
adena	107.3	—	—	10.1	32.9	33.2	15.6	12.4	3.1	—
All counties	5,758.4	41.7	382.9	960.2	1,389.2	1,299.7	828.0	512.9	295.4	48.4

Table 6.—*Area of commercial forest land by county and stand-size class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

County	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Aitkin	672.5	142.0	331.1	196.6	2.8
Becker	313.9	81.1	178.9	53.9	—
Beltrami	794.6	154.8	428.6	196.3	14.9
Cass	858.6	189.0	515.3	148.8	5.5
Clearwater	301.7	77.5	150.4	72.1	1.7
Crow Wing	371.9	81.7	223.4	64.3	2.5
Hubbard	398.0	71.5	242.8	83.7	—
Itasca	1,281.0	308.5	677.2	271.7	23.6
Lake of the Woods	360.6	49.6	144.9	149.3	16.8
Mahnomen	106.4	22.4	56.5	27.5	—
Roseau	191.9	29.7	72.3	87.1	2.8
Wadena	107.3	18.0	61.1	28.2	—
All counties	5,758.4	1,225.8	3,082.5	1,379.5	70.6

Table 7.—*Area of commercial forest land by site and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-225	120-165	85-120	50-85	20-50
National forest	562.3	—	—	1.5	162.5	175.2	223.1
Bureau of Land Mgmt.	35.8	—	—	—	2.8	13.5	19.5
Indian	364.9	—	1.4	5.9	61.6	118.3	177.7
Miscellaneous federal	60.5	—	—	—	1.3	25.8	33.4
State	1,228.7	—	—	10.6	196.5	363.3	658.3
County and municipal	1,096.7	—	—	18.9	255.6	467.6	354.6
Forest industry	233.8	—	1.2	3.9	74.7	64.9	89.1
Farmer	1,322.1	—	—	23.7	227.3	551.9	519.2
Farmer-owned Leased	—	—	—	—	—	—	—
Misc. private-corp.	154.3	—	—	2.6	41.7	67.6	42.4
Misc. private-individual	696.6	—	—	5.5	133.1	260.9	297.1
Misc. priv.-corp., leased	—	—	—	—	—	—	—
Misc. priv.-ind., leased	2.7	—	—	—	—	1.4	1.3
All owners	5,758.4	—	2.6	72.6	1,157.1	2,110.4	2,415.7

Table 8.—*Area of commercial forest land by ownership class and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
National forest	562.3	28.0	57.4	4.4	40.7	2.3	31.4	12.7	7.2	11.1	38.8	58.9	206.9	49.3	—	1.2
Bureau of Land Management	35.8	6.7	1.4	—	—	1.4	3.0	4.8	—	—	1.6	—	12.5	—	2.8	1.6
Indian	364.9	5.2	6.3	7.5	8.5	4.1	38.1	37.2	25.5	7.2	11.7	19.2	156.2	14.6	20.3	3.3
Miscellaneous federal	60.5	2.5	1.3	—	3.2	—	1.6	1.6	5.6	4.0	1.0	7.3	19.7	5.9	5.3	1.5
State	1,228.7	61.3	13.3	1.2	61.7	4.1	123.1	75.1	128.1	19.4	55.0	63.0	443.9	57.6	89.6	32.3
County and municipal	1,096.7	61.9	12.4	1.4	53.8	4.1	37.0	20.2	43.7	32.6	47.5	86.8	560.5	93.2	38.6	3.0
Forest industry	233.8	40.5	9.1	—	8.5	—	6.7	1.5	2.7	7.6	13.0	19.7	105.1	8.9	6.8	3.7
Farmer	1,322.1	74.2	14.1	8.9	35.5	3.1	27.6	17.1	38.6	88.8	92.9	131.7	620.7	76.7	86.5	5.7
Farmer-owned leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private-corp	154.3	7.1	—	—	1.3	—	3.1	—	10.4	12.0	5.7	14.0	84.1	9.2	7.4	—
Misc. private-individual	696.6	40.0	6.6	1.4	12.4	—	6.6	10.6	14.2	63.4	42.6	65.8	330.7	55.8	40.2	6.3
Misc. private corp., leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private ind., leased	2.7	—	—	—	—	—	—	—	—	1.3	—	—	1.4	—	—	—
All owners	5,758.4	327.4	121.9	24.8	225.6	19.1	278.2	180.8	276.0	247.4	309.8	466.4	2,541.7	371.2	297.5	70.6

Table 9.—*Area of commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1977*
(In thousand acres)

Forest type	All ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	140 & over
Jack pine	327.4	9.2	17.6	35.6	79.2	83.3	67.2	27.7	6.5	—	1.1	—	—	—
Red pine	121.9	8.7	3.3	5.1	5.2	9.1	5.1	10.3	39.5	1.4	32.8	1.4	—	—
White pine	24.8	—	—	—	1.3	6.8	2.8	3.0	2.5	1.4	2.6	4.4	—	—
Balsam fir	225.6	11.7	22.0	26.5	17.8	41.4	34.2	58.1	10.9	1.6	—	1.4	—	—
White spruce	19.1	1.4	1.1	3.4	—	—	9.4	2.6	—	1.2	—	—	—	—
Black spruce	278.2	20.6	29.1	53.6	58.0	22.3	30.2	19.5	10.7	22.9	4.0	4.4	2.9	—
Northern white-cedar	180.8	1.6	2.7	8.2	4.1	4.3	18.1	29.4	16.2	22.3	12.4	27.4	30.0	4.1
Tamarack	276.0	18.0	38.7	25.1	16.3	16.3	49.2	12.2	22.4	25.9	6.0	26.0	19.9	—
Oak	247.4	13.2	15.9	7.9	27.9	55.3	46.9	30.8	25.5	7.0	9.6	7.4	—	—
Elm-ash-cottonwood	309.8	14.9	17.7	23.6	16.4	21.4	48.7	33.8	33.4	41.7	34.5	16.9	6.8	—
Maple-basswood	466.4	6.7	13.9	13.7	40.8	95.7	106.1	61.0	46.1	20.3	34.8	7.6	19.7	—
Aspen	2,541.7	290.7	246.3	212.4	446.6	653.1	442.0	164.5	52.5	22.4	6.7	3.1	1.4	—
Paper birch	371.2	5.2	11.9	11.2	46.0	105.2	100.5	52.6	17.8	12.2	4.5	4.1	—	—
Balsam poplar	297.5	35.9	53.4	29.0	47.5	57.6	38.3	21.6	12.8	1.4	—	—	—	—
Nonstocked	70.6	69.1	—	—	—	1.5	—	—	—	—	—	—	—	—
All types	5,758.4	506.9	473.6	455.3	807.1	1,173.3	998.7	527.1	296.8	181.7	149.0	104.1	80.7	4.1

Table 10.—*Area of commercial forest land by forest type, stand-size class, and site class, Northern Pine Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class (cubic feet of growth/acre/year)				
		165 or more	120-165	85-120	50-85	Less than 50
Jack pine						
Sawtimber	105.9	—	1.4	2.4	51.9	50.2
Poletimber	174.6	—	—	8.3	86.1	80.2
Sapling & seedling	46.9	—	—	—	15.9	31.0
All stands	327.4	—	1.4	10.7	153.9	161.4
Red pine						
Sawtimber	94.3	—	—	40.7	45.1	8.5
Poletimber	15.6	—	2.1	6.8	2.7	4.0
Sapling & seedling	12.0	—	—	6.1	4.0	1.9
All stands	121.9	—	2.1	53.6	51.8	14.4
White pine						
Sawtimber	20.9	1.4	5.6	13.9	—	—
Poletimber	3.9	—	—	3.9	—	—
Sapling & seedling	—	—	—	—	—	—
All stands	24.8	1.4	5.6	17.8	—	—
Balsam fir						
Sawtimber	31.6	—	9.6	12.2	6.8	3.0
Poletimber	124.4	1.2	10.9	44.8	25.0	42.5
Sapling & seedling	69.6	—	4.1	15.8	16.3	33.4
All stands	225.6	1.2	24.6	72.8	48.1	78.9
White spruce						
Sawtimber	8.7	—	—	1.2	7.5	—
Poletimber	6.4	—	—	—	4.5	1.9
Sapling & seedling	4.0	—	—	—	2.6	1.4
All stands	19.1	—	—	1.2	14.6	3.3
Black spruce						
Sawtimber	7.1	—	—	—	—	7.1
Poletimber	80.8	—	—	1.6	1.5	77.7
Sapling & seedling	190.3	—	—	—	6.9	183.4
All stands	278.2	—	—	1.6	8.4	268.2
Northern white-cedar						
Sawtimber	35.3	—	—	—	—	35.3
Poletimber	122.5	—	—	—	6.4	116.1
Sapling & seedling	23.0	—	—	—	—	23.0
All stands	180.8	—	—	—	6.4	174.4
Tamarack						
Sawtimber	26.1	—	—	1.3	7.4	17.4
Poletimber	132.2	—	—	—	21.0	111.2
Sapling & seedling	117.7	—	—	—	9.6	108.1
All stands	276.0	—	—	1.3	38.0	236.7
Oak						
Sawtimber	65.5	—	—	2.8	14.4	48.3
Poletimber	143.5	—	—	5.5	48.1	89.9
Sapling & seedling	38.4	—	—	—	9.1	29.3
All stands	247.4	—	—	8.3	71.6	167.5
Elm-ash-cottonwood						
Sawtimber	76.4	—	—	—	10.5	65.9
Poletimber	169.5	—	—	1.1	14.3	154.1
Sapling & seedling	63.9	—	—	—	—	63.9
All stands	309.8	—	—	1.1	24.8	283.9
Maple-basswood						
Sawtimber	179.0	—	—	10.2	60.5	108.3
Poletimber	252.9	—	—	21.8	75.7	155.4
Sapling & seedling	34.5	—	—	—	4.4	30.1
All stands	466.4	—	—	32.0	140.6	293.8
Aspen						
Sawtimber	452.4	—	8.7	184.5	213.8	35.4
Poletimber	1,451.4	—	8.8	607.4	697.0	128.2
Sapling & seedling	637.9	—	—	120.8	351.0	166.1
All stands	2,541.7	—	7.5	912.7	261.8	329.7
Paper birch						
Sawtimber	55.9	—	—	1.4	25.0	29.5
Poletimber	288.3	—	1.4	6.7	92.3	187.9
Sapling & seedling	27.0	—	—	1.3	11.2	14.5
All stands	371.2	—	1.4	9.4	128.5	231.9
Balsam poplar						
Sawtimber	66.7	—	—	10.1	41.3	15.3
Poletimber	116.5	—	—	18.7	52.6	45.2
Sapling & seedling	114.3	—	—	4.6	56.0	53.7
All stands	297.5	—	—	33.4	149.9	114.2
Nonstocked	70.6	—	—	1.2	12.0	57.4
All types	5,758.4	2.6	72.6	1,157.1	2,110.4	2,415.7

Table 11.—*Area of noncommercial forest land by ownership class, Northern Pine Unit, Minnesota, 1977*

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National forest	28.2	1.9	26.3
Other federal	70.8	1.7	69.1
State, county, and municipal	584.4	43.3	541.1
Forest industry	4.3	—	4.3
Farmer	53.8	—	53.8
Miscellaneous private	12.3	—	12.3
All ownerships	753.8	46.9	706.9

Table 12.—*Area of noncommercial forest land by forest type, Northern Pine Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Jack pine	4.3	2.7	1.6
Red-white pine	6.7	6.7	—
Spruce-fir	15.5	1.4	14.1
Black spruce	382.6	5.8	376.8
Northern white-cedar	43.8	0.2	43.6
Tamarack	69.8	0.2	69.6
Oak	10.7	—	10.7
Elm-ash-cottonwood	132.9	4.2	128.7
Maple-basswood	7.5	5.5	2.0
Aspen-birch	80.0	20.2	59.8
Nonstocked	—	—	—
All forest types	753.8	46.9	706.9

Table 13.—*Number of all live trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:															
White pine	14,102	3,457	3,641	2,645	947	1,224	381	464	487	375	117	143	205	13	3
Red pine	31,668	8,737	6,594	3,629	4,097	2,147	1,554	1,432	1,513	1,093	378	366	124	4	—
Jack pine	140,162	33,999	39,097	30,714	21,249	9,438	3,908	1,277	382	78	11	8	1	—	—
White spruce	23,804	11,044	6,411	3,291	1,271	769	466	249	148	83	45	18	9	—	—
Black spruce	237,495	116,930	80,809	29,509	8,159	1,769	235	50	22	4	8	—	—	—	—
Balsam fir	299,932	160,104	70,255	40,960	18,619	6,848	2,269	589	191	92	2	3	—	—	—
Tamarack	127,461	47,342	36,801	28,923	10,012	3,262	892	168	43	13	3	—	2	—	—
Northern white-cedar	109,748	30,714	24,919	27,987	14,430	6,797	3,103	1,117	432	156	62	23	8	—	—
Other softwoods	262	—	—	189	24	21	12	9	4	—	3	—	—	—	—
Total softwoods	984,634	412,327	268,527	167,847	78,808	32,275	12,820	5,355	3,222	1,894	629	561	349	17	3
Hardwoods:															
Select white oaks	110,201	51,668	29,967	14,681	6,909	3,356	1,880	865	441	230	103	57	41	3	—
Select red oaks	72,256	17,228	13,956	15,714	12,053	6,802	3,480	1,710	730	311	169	63	37	3	—
Other red oaks	798	378	138	157	69	41	8	4	—	3	—	—	—	—	—
Hickory	198	—	123	—	57	10	8	—	—	—	—	—	—	—	—
Yellow birch	4,147	2,089	762	610	262	133	103	114	30	22	7	8	6	1	—
Hard maple	147,326	87,570	35,534	12,503	4,927	3,287	1,518	1,063	573	224	81	30	14	2	—
Soft maple	114,274	61,152	30,776	13,737	5,507	1,704	647	295	225	112	54	27	28	10	—
Ash	252,341	143,067	56,172	28,103	14,155	6,723	2,597	943	393	116	58	7	7	—	—
Balsam poplar	161,304	79,396	34,459	21,045	13,083	7,009	3,783	1,621	642	176	58	11	21	—	—
Paper birch	263,090	74,238	70,902	63,973	32,431	14,010	5,063	1,785	488	132	45	16	7	—	—
Bigtooth aspen	32,723	9,408	5,521	5,153	5,684	3,909	1,815	787	290	109	35	10	2	—	—
Quaking aspen	777,819	375,357	136,472	98,444	76,565	50,614	24,766	9,892	3,732	1,370	400	159	47	1	—
Basswood	94,858	35,572	21,291	16,280	10,479	6,138	2,848	1,244	552	258	103	54	37	2	—
Elm	89,724	40,406	19,311	12,343	8,050	4,356	2,283	1,332	722	466	210	127	100	18	—
Select hardwoods	6,329	3,313	2,050	599	253	79	22	5	7	—	—	—	1	—	—
Other hardwoods	5,232	2,903	1,341	547	247	86	44	24	17	3	12	4	4	—	—
Noncommercial species	76,332	65,747	8,229	1,981	239	80	44	—	8	—	4	—	—	—	—
Total hardwoods	2,208,952	1,049,492	467,004	305,870	190,970	108,337	50,909	21,684	8,850	3,532	1,339	573	352	40	—
All species	3,193,586	1,461,819	735,531	473,717	269,778	140,612	63,729	27,039	12,072	5,426	1,968	1,134	701	57	3

Table 14.—*Number of growing-stock trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods															
White pine	11,705	2,647	3,059	2,083	738	1,195	360	441	366	369	116	131	187	10	3
Red pine	29,529	7,105	6,594	3,282	4,008	2,105	1,548	1,419	1,515	1,088	373	365	124	3	—
Jack pine	116,948	23,269	31,940	27,698	19,825	8,992	3,676	1,142	319	72	6	8	1	—	—
White spruce	21,289	8,956	6,276	3,113	1,223	716	453	249	148	83	45	18	9	—	—
Black spruce	177,347	75,479	66,682	25,502	7,748	1,637	220	49	18	4	8	—	—	—	—
Balsam fir	258,386	128,124	65,369	37,740	17,792	6,434	2,153	528	170	71	2	3	—	—	—
Tamarack	105,253	40,019	28,783	24,141	8,694	2,685	756	134	29	10	—	—	2	—	—
Northern white-cedar	77,626	22,794	18,465	18,962	9,963	4,387	1,882	730	285	103	43	8	4	—	—
Other softwoods	106	—	—	76	24	—	6	—	—	—	—	—	—	—	—
Total softwoods	798,189	308,393	227,168	142,597	70,015	28,151	11,054	4,692	2,850	1,800	593	533	327	13	3
Hardwoods:															
Select white oaks	89,517	38,981	25,886	12,642	6,033	2,935	1,619	746	346	173	85	38	31	2	—
Select red oaks	57,252	12,659	10,216	12,522	10,625	6,052	2,803	1,351	571	252	127	39	33	2	—
Other red oaks	718	378	138	90	56	41	8	4	—	3	—	—	—	—	—
Hickory	198	—	123	—	57	10	8	—	—	—	—	—	—	—	—
Yellow birch	2,133	1,103	504	246	99	52	55	45	12	11	3	2	1	—	—
Hard maple	105,767	61,495	28,978	8,734	3,158	1,563	815	572	265	135	33	12	1	1	—
Soft maple	71,241	35,581	21,757	9,406	2,727	1,033	376	141	97	62	31	10	16	4	—
Ash	201,976	109,541	46,549	24,232	12,351	5,748	2,251	811	340	92	53	5	3	—	—
Balsam poplar	135,790	67,936	27,803	17,270	11,173	6,066	3,355	1,402	573	145	42	7	18	—	—
Paper birch	204,134	50,785	57,844	50,255	27,076	12,163	4,063	1,444	369	93	33	6	3	—	—
Bigtooth aspen	25,339	6,555	4,314	4,216	4,601	3,337	1,460	563	205	74	10	4	—	—	—
Quaking aspen	602,327	293,054	106,650	74,988	59,636	39,652	18,415	6,795	2,233	676	156	56	16	—	—
Basswood	74,343	24,953	16,249	13,822	9,535	5,385	2,553	1,084	446	188	77	31	19	1	—
Elm	69,716	28,794	16,527	10,196	6,418	3,529	1,827	1,083	598	395	172	92	76	9	—
Select hardwoods	3,140	2,247	412	247	145	60	22	—	7	—	—	—	—	—	—
Other hardwoods	3,457	2,137	979	144	108	44	26	11	5	—	3	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	1,647,048	736,199	364,929	239,010	153,798	87,670	39,656	16,052	6,067	2,299	825	302	222	19	—
All species	2,445,237	1,044,592	592,097	381,607	223,813	115,821	50,710	20,744	8,917	4,099	1,418	835	549	32	3

able 15.—*Number of short-log trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*

(In thousand trees)

pecies	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
oftwoods:											
White pine	18	—	—	9	3	—	2	—	4	—	—
Red pine	31	22	—	4	—	3	2	—	—	—	—
Jack pine	202	112	47	35	8	—	—	—	—	—	—
White spruce	26	26	—	—	—	—	—	—	—	—	—
Black spruce	42	38	—	—	4	—	—	—	—	—	—
Balsam fir	149	107	14	10	4	14	—	—	—	—	—
Tamarack	192	124	62	6	—	—	—	—	—	—	—
Northern white-cedar	555	330	155	32	19	12	3	2	2	—	—
Other softwoods	18	11	—	—	4	—	3	—	—	—	—
Total softwoods	1,233	770	278	96	42	29	10	2	6	—	—
ardwoods:											
Select white oaks	186	—	102	45	19	12	—	8	—	—	—
Select red oaks	353	—	174	112	43	17	3	4	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	41	—	12	22	5	—	—	2	—	—	—
Hard maple	271	—	88	102	53	14	7	4	3	—	—
Soft maple	88	—	27	14	15	8	9	4	7	4	—
Ash	176	—	121	24	24	3	—	2	2	—	—
Balsam poplar	150	—	82	36	16	16	—	—	—	—	—
Paper birch	323	—	187	76	44	12	—	—	4	—	—
Bigtooth aspen	130	—	56	45	12	17	—	—	—	—	—
Quaking aspen	2,142	—	1,248	507	244	97	28	10	8	—	—
Basswood	158	—	71	34	26	12	10	5	—	—	—
Elm	378	—	204	67	47	23	15	10	9	3	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	4,396	—	2,372	1,084	548	231	72	49	33	7	—
All species	5,629	770	2,650	1,180	590	260	82	51	39	7	—

Table 16.—*Net volume of growing stock and sawtimber on commercial forest land by species, Northern Pine Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	[1]1962	1977	[1]1962	1977
	Thousand cubic feet		*Thousand board feet*[2]	
Softwoods:				
White pine	71,497	90,495	335,521	489,804
Red pine	191,411	273,024	900,416	1,310,295
Jack pine	304,917	370,689	583,306	952,613
Spruce	144,741	155,751	151,211	255,963
Balsam fir	262,132	328,134	271,097	588,296
Tamarack	145,681	150,313	135,542	210,950
Northern white-cedar	89,087	140,654	133,292	373,920
Other softwoods	—	394	—	364
Total softwoods	1,209,466	1,509,454	2,510,385	4,182,205
Hardwoods:				
White oak	76,765	119,986	225,083	264,498
Red oak	139,834	218,539	331,407	440,724
Yellow birch	3,597	3,552	16,515	11,866
Hard maple	62,866	83,680	212,342	204,393
Soft maple	33,525	49,757	82,683	75,450
Ash	174,528	241,200	310,468	352,993
Paper birch	334,140	538,764	194,904	570,799
Aspen	1,270,624	1,642,259	1,005,318	3,056,545
Basswood	124,132	203,813	371,875	413,860
Elm	93,681	141,808	344,830	468,485
Other hardwoods	193,156	270,082	295,567	578,932
Total hardwoods	2,506,848	3,513,440	3,390,992	6,438,545
All species	3,716,314	5,022,894	5,901,377	10,620,750

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.
[2]International ¼-inch rule.

Table 17.—*Cubic foot volume in all live trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)										
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	95,678	4,469	4,032	10,816	5,020	9,981	12,334	15,402	5,953	8,395	17,397	1,561	318
Red pine	274,941	8,896	25,971	25,081	27,589	37,652	51,059	49,138	20,036	20,746	8,446	327	—
Jack pine	388,506	73,337	117,397	93,335	62,289	27,630	10,856	2,612	582	396	72	—	—
White spruce	43,384	5,256	5,224	6,424	7,068	6,044	4,857	3,495	2,775	1,372	869	—	—
Black spruce	119,809	59,086	39,715	15,317	3,373	1,055	793	115	355	—	—	—	—
Balsam fir	344,770	97,414	103,901	73,438	43,633	14,730	7,026	4,301	85	242	—	—	—
Tamarack	166,518	67,064	51,143	30,032	13,202	3,492	1,037	418	35	—	95	—	—
Northern white-cedar	179,278	36,243	43,402	38,022	29,270	16,917	8,586	3,993	1,876	690	279	—	—
Other softwoods	907	303	121	99	128	113	73	—	70	—	—	—	—
Total softwoods	1,613,791	352,068	390,906	292,564	191,572	117,614	96,621	79,474	31,767	31,841	27,158	1,888	318
Hardwoods:													
Select white oaks	134,111	24,843	27,588	24,238	20,706	14,340	9,319	5,776	3,514	2,105	1,552	130	—
Select red oaks	243,686	31,749	55,611	54,407	40,149	28,024	15,571	8,342	5,767	2,095	1,738	233	—
Other red oaks	1,061	252	262	315	58	85	—	89	—	—	—	—	—
Hickory	520	—	335	99	86	—	—	—	—	—	—	—	—
Yellow birch	6,469	861	801	803	998	1,325	614	423	144	288	186	26	—
Hard maple	127,878	23,386	19,965	24,803	17,508	18,556	12,305	6,855	2,538	1,164	696	102	—
Soft maple	68,659	18,271	15,025	10,369	6,524	4,300	4,473	3,512	2,170	1,116	1,931	968	—
Ash	265,524	58,707	69,340	60,826	38,397	19,408	11,094	4,031	2,982	336	403	—	—
Balsam poplar	290,588	42,720	65,662	65,490	55,341	33,859	17,623	6,117	2,033	582	1,161	—	—
Paper birch	614,334	155,209	182,983	142,070	75,121	38,346	13,556	4,355	1,957	500	237	—	—
Bigtooth aspen	143,005	13,488	33,778	40,042	27,265	15,812	7,520	3,478	1,187	391	44	—	—
Quaking aspen	1,832,504	232,453	420,996	488,496	355,453	191,083	88,185	36,780	12,110	5,101	1,826	21	—
Basswood	225,603	30,818	50,163	51,114	38,201	24,034	14,448	8,041	4,428	2,098	2,122	136	—
Elm	160,028	13,647	21,701	23,589	23,277	21,119	16,504	15,208	9,022	6,489	7,133	2,339	—
Select hardwoods	2,802	911	819	594	272	—	170	—	—	—	36	—	—
Other hardwoods	3,923	778	849	623	545	290	338	58	244	111	87	—	—
Noncommercial species	3,186	1,536	671	380	280	—	184	—	135	—	—	—	—
Total hardwoods	4,123,881	649,629	966,549	988,258	700,181	410,581	211,904	103,065	48,231	22,376	19,152	3,955	—
All species	5,737,672	1,001,697	1,357,455	1,280,822	891,753	528,195	308,525	182,539	79,998	54,217	46,310	5,843	318

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwooods and hardwoods, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing-stock trees:			
Sawlog trees:			
Sawlog portion	1,554,831	643,454	911,377
Upper-stem portion	515,829	178,157	337,672
Total sawtimber	2,070,660	821,611	1,249,049
Poletimber trees	2,952,234	687,843	2,264,391
Total growing stock	5,022,894	1,509,454	3,513,440
Cull trees:			
Rough and rotten cull trees:			
Sawtimber	234,059	37,606	196,453
Poletimber	395,173	55,130	340,043
Total rough and rotten cull	629,232	92,736	536,496
Short-log cull trees:			
Sawtimber	85,546	11,601	73,945
Poletimber	—	—	—
Total short-log	85,546	11,601	73,945
Total cull	714,778	104,337	610,441
Salvable dead trees:	66,139	30,217	35,922
All classes	5,803,811	1,644,008	4,159,803

Table 19.—*Net volume of growing stock on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods													
White pine	90,495	4,215	3,979	16,501	30,615	5,309	3,256	3,693	22,334	155	30	—	408
Red pine	273,024	1,913	7,151	37,806	84,764	10,303	14,457	19,439	89,874	2,765	90	—	4,462
Jack pine	370,689	2,244	22,148	50,695	70,765	6,016	40,629	66,626	45,407	24,196	1,375	16,466	24,122
White spruce	42,389	3,663	2,711	6,300	3,356	1,173	981	2,503	16,942	2,718	255	1,297	490
Black spruce	113,362	9,767	2,502	20,026	10,223	3,954	242	3,478	42,398	15,710	63	4,710	289
Balsam fir	328,134	22,870	9,606	40,957	50,581	10,647	4,680	7,290	166,592	11,176	271	3,362	102
Tamarack	150,313	26,802	7,191	33,810	14,714	9,157	5,251	4,126	24,428	14,326	1,067	8,258	1,183
Northern white-cedar	140,654	7,096	—	37,716	20,161	1,994	250	1,126	53,083	14,135	—	5,093	—
Other softwoods	394	184	—	—	89	—	—	—	121	—	—	—	—
Total softwoods	1,509,454	78,754	55,288	243,811	285,268	48,553	69,746	108,281	461,179	85,181	3,151	39,186	31,056
Hardwoods													
Select white oak	119,986	11,865	17,105	10,412	20,687	8,129	15,675	10,855	7,458	965	11,517	1,178	4,140
Select red oak	217,524	26,231	23,645	5,723	49,927	10,592	57,066	18,070	17,168	—	5,228	—	3,874
Other red oaks	1,015	69	792	—	—	—	—	154	—	—	—	—	—
Hickory	520	247	—	—	—	—	273	—	—	—	—	—	—
Yellow birch	3,552	1,058	—	242	—	—	539	—	1,713	—	—	—	—
Hard maple	83,680	33,654	7,360	7,607	7,097	5,013	3,371	1,456	16,437	—	1,685	—	—
Soft maple	49,757	17,460	746	3,605	8,374	1,626	5,013	1,274	11,472	—	130	—	57
Ash	241,200	58,992	10,424	33,787	24,620	8,062	13,566	4,220	68,856	5,957	4,326	5,217	3,173
Balsam poplar	265,529	18,776	6,696	56,929	20,728	22,401	824	9,629	75,839	26,024	7,134	16,215	4,334
Paper birch	538,764	54,527	38,416	60,633	114,616	28,339	40,456	34,933	141,622	12,735	6,114	4,693	1,680
Bigtooth aspen	123,016	5,550	8,765	7,510	29,399	8,368	17,259	19,760	24,860	754	—	—	791
Quaking aspen	1,519,243	117,873	98,684	205,710	245,129	92,627	91,741	127,877	401,816	57,925	29,118	29,068	21,675
Basswood	203,813	40,199	19,875	24,199	29,977	15,215	8,131	5,863	44,264	777	14,371	238	704
Elm	141,808	21,825	16,138	23,286	18,269	17,749	2,645	2,110	24,353	2,483	8,118	3,565	1,267
Select hardwoods	2,005	404	553	—	89	—	862	42	—	—	55	—	—
Other hardwoods	2,028	130	581	281	90	123	—	—	118	—	424	56	225
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	408,860	249,780	439,924	569,002	218,244	257,421	236,243	835,976	107,620	88,220	60,230	41,920
All species	5,022,894	487,614	305,068	683,735	854,270	266,797	327,167	344,524	1,297,155	192,801	91,371	99,416	72,976

Table 20.—*Net volume of sawtimber on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods													
White pine	489,804	23,822	20,725	83,667	170,166	30,974	16,376	18,413	121,642	1,186	—	—	2,833
Red pine	1,310,295	10,130	32,424	170,545	433,619	51,618	63,579	84,801	443,006	4,594	568	—	15,411
Jack pine	952,613	4,144	55,290	148,006	178,454	15,719	83,806	167,348	139,345	60,432	2,196	53,389	44,484
White spruce	168,448	15,812	11,404	21,862	15,172	5,236	2,443	11,458	67,493	9,472	1,220	4,391	2,485
Black spruce	87,515	4,235	3,366	10,791	9,289	4,836	—	8,964	34,315	7,498	—	3,868	353
Balsam fir	588,296	43,820	20,283	70,115	103,746	17,551	5,178	11,391	293,388	15,064	510	7,250	—
Tamarack	210,950	38,801	15,581	38,607	15,806	21,048	10,789	7,627	34,840	17,615	3,829	6,407	—
Northern white-cedar	373,920	21,282	—	59,471	69,147	7,635	—	5,307	167,938	26,616	—	16,524	—
Other softwoods	364	—	—	—	364	—	—	—	—	—	—	—	—
Total softwoods	4,182,205	162,046	159,073	603,064	995,763	154,617	182,171	315,309	1,301,967	142,477	8,323	91,829	65,566
Hardwoods													
Select white oaks	264,498	25,811	48,217	19,484	45,659	16,444	31,990	19,247	17,575	3,731	25,666	3,313	7,361
Select red oaks	439,583	69,744	61,925	6,823	92,021	32,191	110,207	23,369	22,197	—	9,407	—	11,699
Other red oaks	1,141	—	851	—	—	—	—	290	—	—	—	—	—
Hickory	444	—	—	—	—	—	444	—	—	—	—	—	—
Yellow birch	11,866	2,453	—	328	—	—	2,382	—	6,703	—	—	—	—
Hard maple	204,393	103,735	10,714	16,942	11,467	10,733	4,113	1,624	42,377	—	2,688	—	—
Soft maple	75,450	31,032	366	7,448	7,251	4,227	5,958	1,137	18,031	—	—	—	—
Ash	352,993	90,178	15,215	53,566	38,774	12,276	17,759	4,741	94,710	7,210	7,206	5,024	6,334
Balsam poplar	572,553	59,634	16,354	97,274	53,054	38,128	1,000	16,668	197,456	46,607	17,169	22,270	6,939
Paper birch	570,799	69,701	53,639	82,687	104,251	23,491	18,736	20,204	156,431	21,987	10,874	8,798	—
Bigtooth aspen	213,453	17,453	12,878	16,513	57,824	8,589	30,658	12,728	56,810	—	—	—	—
Quaking aspen	2,843,092	234,261	140,893	371,134	506,972	139,917	165,077	186,816	886,148	98,880	47,271	43,336	22,387
Basswood	413,860	93,966	46,920	55,007	57,584	25,648	14,202	3,473	91,870	3,847	17,612	819	2,912
Elm	468,485	78,612	52,112	76,404	57,292	55,062	6,704	2,932	95,708	9,839	20,909	7,979	4,932
Select hardwoods	2,223	916	—	—	—	—	1,307	—	—	—	—	—	—
Other hardwoods	3,712	330	1,204	1,056	—	—	—	—	—	—	1,122	—	—
Noncommercial	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	877,826	461,288	804,666	1,032,149	366,706	410,537	293,229	1,686,016	192,101	159,924	91,539	62,564
All species	10,620,750	1,039,872	620,361	1,407,730	2,027,912	521,323	592,708	608,538	2,987,983	334,578	168,247	183,368	128,130

[1]International ¼-inch rule.

Table 21.—*Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Northern Pine Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				Thousand board feet[1]
Softwoods:					
White pine	95,678	90,495	563	4,620	489,804
Red pine	274,941	273,024	402	1,515	1,310,295
Jack pine	388,506	370,689	2,067	15,750	952,613
White spruce	43,384	42,389	117	878	168,448
Black spruce	119,809	113,362	421	6,026	87,515
Balsam fir	344,770	328,134	1,890	14,746	588,296
Tamarack	166,518	150,313	1,798	14,407	210,950
Northern white-cedar	179,278	140,654	4,140	34,484	373,920
Eastern redcedar	907	394	203	310	364
Total softwoods	1,613,791	1,509,454	11,601	92,736	4,182,205
Hardwoods:					
White oak	2,636	2,574	—	62	6,139
Burr oak	131,475	117,412	2,442	11,621	258,359
Swamp white oak	—	—	—	—	—
Northern red oak	243,686	217,524	4,762	21,400	439,583
Black oak	—	—	—	—	—
Northern pin oak	1,061	1,015	—	46	1,141
Bitternut hickory	520	520	—	—	444
Shagbark hickory	—	—	—	—	—
Yellow birch	6,469	3,552	575	2,342	11,866
Sugar maple	127,878	83,680	5,387	38,811	204,393
Black maple	—	—	—	—	—
Red maple	58,518	41,882	1,052	15,584	46,619
Silver maple	10,141	7,875	1,112	1,154	28,831
White ash	336	—	—	336	—
Black ash	235,759	215,469	2,969	17,321	316,683
Green ash	29,429	25,731	—	3,698	36,310
Balsam poplar	290,588	265,529	2,542	22,517	572,553
Paper birch	614,334	538,764	5,385	70,185	570,799
Bigtooth aspen	143,005	123,016	2,472	17,517	213,453
Quaking aspen	1,832,504	1,519,243	36,840	276,421	2,843,092
Basswood	225,603	203,813	2,976	18,814	413,860
American elm	154,610	136,658	5,431	12,521	448,189
Slippery elm	4,385	4,153	—	232	18,380
Rock elm	1,033	997	—	36	1,916
Butternut	1,394	1,266	—	128	2,223
Black walnut	—	—	—	—	—
Black cherry	1,408	739	—	669	—
Boxelder	3,715	1,820	—	1,895	3,712
River birch	—	—	—	—	—
Hackberry	—	—	—	—	—
Eastern cottonwood	118	118	—	—	—
Black willow	90	90	—	—	—
Noncommercial	3,186	—	—	3,186	—
Total hardwoods	4,123,881	3,513,440	73,945	536,496	6,438,545
All species	5,737,672	5,022,894	85,546	629,232	10,620,750

[1]International ¼-inch rule.

Table 22.—*Net volume of growing stock on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:													
White pine	90,495	3,638	3,271	10,584	4,926	9,637	10,787	15,309	5,867	8,038	16,709	1,411	318
Red pine	273,024	8,353	25,535	24,814	27,496	37,402	51,059	49,028	19,860	20,716	8,446	315	—
Jack pine	370,689	69,484	112,716	90,278	59,705	25,626	9,537	2,515	360	396	72	—	—
White spruce	42,389	4,961	5,042	6,129	6,845	6,044	4,857	3,495	2,775	1,372	869	—	—
Black spruce	113,362	54,639	38,694	14,565	3,312	1,055	627	115	355	—	—	—	—
Balsam fir	328,134	90,093	100,490	70,663	42,513	13,838	6,700	3,509	86	242	—	—	—
Tamarack	150,313	59,648	47,124	26,917	12,183	3,074	910	362	—	—	95	—	—
Northern white-cedar	140,654	28,818	35,033	29,726	21,880	13,400	6,529	3,261	1,507	369	131	—	—
Other softwoods	394	184	121	—	89	—	—	—	—	—	—	—	—
Total softwoods	1,509,454	319,818	368,026	273,676	178,949	110,076	91,006	77,594	30,810	31,133	26,322	1,726	318
Hardwoods:													
Select white oaks	119,986	22,703	25,181	21,797	18,532	12,694	7,869	4,886	3,176	1,702	1,344	102	—
Select red oaks	217,524	27,800	51,694	50,566	34,890	23,593	13,187	7,345	5,133	1,544	1,615	157	—
Other red oaks	1,015	212	256	315	58	85	—	89	—	—	—	—	—
Hickory	520	—	335	99	86	—	—	—	—	—	—	—	—
Yellow birch	3,552	502	511	381	612	699	269	317	78	111	72	—	—
Hard maple	83,680	18,362	14,569	13,572	11,144	11,694	7,318	4,700	1,284	579	398	60	—
Soft maple	49,757	15,263	10,743	7,776	4,816	2,568	2,631	2,201	1,398	562	1,234	565	—
Ash	241,200	52,807	64,318	55,060	35,017	17,688	9,776	3,324	2,739	237	234	—	—
Balsam poplar	265,529	37,697	59,938	59,691	51,827	31,160	16,361	5,462	1,824	450	1,119	—	—
Paper birch	538,764	132,145	160,837	128,545	65,868	34,065	11,519	3,575	1,742	335	133	—	—
Bigtooth aspen	123,016	11,793	29,422	36,139	23,659	12,662	5,956	2,657	508	220	—	—	—
Quaking aspen	1,519,243	197,905	358,962	419,307	294,952	151,105	63,569	23,466	6,500	2,586	891	—	—
Basswood	203,813	27,229	46,640	46,889	35,350	22,101	12,653	6,491	3,605	1,340	1,466	49	—
Elm	141,808	12,578	19,636	21,371	20,648	18,683	14,813	13,849	7,932	5,322	5,707	1,269	—
Select hardwoods	2,005	468	567	528	272	—	170	—	—	—	—	—	—
Other hardwoods	2,028	406	465	410	327	183	124	—	113	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	557,870	844,074	862,446	598,058	338,980	166,215	78,362	36,032	14,988	14,213	2,202	—
All species	5,022,894	877,688	1,212,100	1,136,122	777,007	449,056	257,221	155,956	66,842	46,121	40,535	3,928	318

Table 23.—*Net volume of sawtimber on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	489,804	69,371	29,254	55,674	61,709	85,998	33,193	45,080	98,478	8,716	2,331
Red pine	1,310,295	121,529	134,725	188,676	267,237	277,045	120,786	135,990	61,136	3,171	—
Jack pine	952,613	484,952	290,581	118,682	42,763	11,810	1,539	1,991	295	—	—
White spruce	168,448	32,947	35,084	30,379	24,767	18,061	14,879	7,495	4,836	—	—
Black spruce	87,515	63,503	13,933	4,569	3,087	577	1,846	—	—	—	—
Balsam fir	588,296	307,453	176,728	57,004	29,345	16,019	382	1,365	—	—	—
Tamarack	210,950	127,968	58,941	15,737	5,219	2,165	—	—	920	—	—
Northern white-cedar	373,920	151,706	103,693	62,124	31,194	15,110	7,396	1,923	774	—	—
Other softwoods	364	—	364	—	—	—	—	—	—	—	—
Total softwoods	4,182,205	1,359,429	843,303	532,845	465,321	426,785	180,021	193,844	166,439	11,887	2,331
Hardwoods:											
Select white oaks	264,498	—	95,249	65,642	40,814	25,248	17,211	9,686	9,741	907	—
Select red oaks	439,583	—	171,605	119,408	65,710	37,653	26,775	8,427	8,953	1,052	—
Other red oaks	1,141	—	290	337	—	514	—	—	—	—	—
Hickory	444	—	444	—	—	—	—	—	—	—	—
Yellow birch	11,866	—	3,049	3,396	1,945	1,999	436	592	449	—	—
Hard maple	204,393	—	60,557	63,771	39,956	26,241	7,346	3,593	2,459	470	—
Soft maple	75,450	—	24,463	12,796	12,056	10,366	6,412	2,329	4,757	2,271	—
Ash	352,993	—	172,163	91,169	51,135	18,779	16,307	1,537	1,903	—	—
Balsam poplar	572,553	—	270,470	164,489	86,145	30,216	10,477	2,804	7,952	—	—
Paper birch	570,799	—	332,638	159,818	52,042	16,148	8,293	1,327	533	—	—
Bigtooth aspen	213,453	—	108,533	60,444	28,233	12,362	2,461	1,420	—	—	—
Quaking aspen	2,843,092	—	1,598,964	768,066	317,474	111,549	30,414	12,473	4,152	—	—
Basswood	413,860	—	171,344	109,616	63,635	34,227	18,583	7,509	8,489	457	—
Elm	468,485	—	120,341	103,215	76,765	69,067	40,211	25,549	27,313	6,024	—
Select hardwoods	2,223	—	1,307	—	916	—	—	—	—	—	—
Other hardwoods	3,712	—	1,620	897	611	—	584	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	—	3,133,037	1,723,064	837,437	394,369	185,510	77,246	76,701	11,181	—
All species	10,620,750	1,359,429	3,976,340	2,255,909	1,302,758	821,154	365,531	271,090	243,140	23,068	2,331

[1]International ¼-inch rule.

Table 24.—*Net volume of growing stock on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	90,495	1,038	30,816	21,468	1,616	572	41	91	715	1,465	386	7,456	17,257	7,237	337	—
Red pine	273,024	33,592	149,314	12,384	3,018	413	—	—	514	4,510	70	661	53,624	14,701	223	—
Jack pine	370,689	283,392	7,526	1,739	1,691	2,249	395	98	837	6,503	141	144	57,224	7,661	1,089	—
White spruce	42,389	1,330	760	485	4,647	4,964	334	500	358	497	1,218	2,560	19,762	3,273	1,701	—
Black spruce	113,362	3,748	320	249	14,174	324	60,131	12,426	12,265	86	459	106	6,765	1,333	840	136
Balsam fir	328,134	1,728	11,802	1,321	74,489	1,503	4,087	8,338	1,946	513	18,267	28,504	127,485	28,255	16,265	3,631
Tamarack	150,313	125	195	—	5,416	277	13,357	7,804	104,587	214	1,706	500	8,226	3,641	3,879	386
Northern white-cedar	140,654	—	—	—	10,842	566	3,630	82,394	2,829	—	19,622	1,936	10,336	5,838	2,480	181
Other softwoods	394	—	—	—	—	—	184	—	—	—	89	—	—	—	121	—
Total softwoods	1,509,454	324,953	200,733	37,646	115,893	10,868	82,159	111,651	124,051	13,788	41,958	41,867	300,679	71,939	26,935	4,334
Hardwoods:																
Select white oaks	119,986	823	226	320	613	29	—	—	—	30,760	4,310	19,154	56,346	5,896	1,509	—
Select red oaks	217,524	2,628	742	108	62	—	112	—	51	84,206	684	22,882	83,961	21,723	365	—
Other red oaks	1,015	—	—	—	—	—	—	—	—	58	—	89	799	69	—	—
Hickory	520	—	—	—	—	—	—	—	—	189	—	146	—	185	—	—
Yellow birch	3,552	—	—	—	—	—	—	—	—	—	627	2,407	169	349	—	—
Hard maple	83,680	—	—	221	—	—	—	—	—	1,159	755	61,397	15,248	4,174	726	—
Soft maple	49,757	66	56	42	494	—	179	—	117	2,837	6,873	17,552	17,291	4,138	112	—
Ash	241,200	64	129	—	4,179	—	336	2,996	336	1,895	126,484	38,969	44,362	11,914	9,536	—
Balsam poplar	265,529	579	559	46	6,580	622	118	2,160	2,008	782	12,875	9,605	108,432	11,562	109,601	—
Paper birch	538,764	6,965	20,457	2,836	16,945	369	970	5,299	1,917	22,101	14,596	46,230	213,668	174,661	10,713	1,037
Bigtooth aspen	123,016	3,248	2,786	—	66	—	204	—	—	6,155	1,104	5,542	97,035	6,760	116	—
Quaking aspen	1,519,243	14,134	5,609	1,388	14,495	2,101	2,405	934	1,678	24,825	10,695	43,292	1,328,065	36,080	31,854	1,688
Basswood	203,813	63	—	465	970	—	—	—	—	9,590	7,641	123,967	49,579	10,007	1,531	—
Elm	141,808	124	43	—	1,015	—	79	54	484	2,391	30,834	51,212	39,878	9,027	6,667	—
Select hardwoods	2,005	—	—	—	—	—	—	—	—	839	—	402	605	159	—	—
Other hardwoods	2,028	225	118	—	—	—	—	—	—	76	184	1,149	276	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	28,919	30,725	5,426	45,419	3,121	4,403	11,443	6,591	187,863	217,662	443,995	2,055,714	296,704	172,730	2,725
All species	5,022,894	353,872	231,458	43,072	161,312	13,989	86,562	123,094	130,642	201,651	259,620	485,862	2,356,393	368,643	199,665	7,059

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods:																
White pine	489,804	4,918	170,415	113,793	9,677	3,353	286	644	4,371	8,376	2,188	42,247	86,718	40,905	1,913	—
Red pine	1,310,295	122,058	758,670	63,199	14,319	1,670	—	—	2,293	19,774	—	3,790	248,828	74,625	1,069	—
Jack pine	952,613	664,539	26,528	5,178	7,818	9,631	1,845	253	2,319	18,450	—	513	186,662	27,981	896	—
White spruce	168,448	2,235	1,433	1,853	19,209	17,981	623	1,579	1,028	2,357	4,832	11,904	81,185	15,204	7,025	—
Black spruce	87,515	3,781	—	547	19,004	1,404	28,810	12,945	6,673	353	1,169	—	8,324	2,018	2,103	384
Balsam fir	588,296	2,096	41,149	1,685	118,422	1,849	4,184	6,338	2,496	493	29,357	66,166	224,730	43,085	36,243	10,003
Tamarack	210,950	687	354	—	11,633	1,174	16,550	6,185	111,118	1,101	3,974	1,213	27,530	12,131	15,546	1,754
Northern white-cedar	373,920	—	—	—	32,673	2,251	7,209	176,672	6,217	—	74,936	6,444	35,530	21,887	9,296	805
Other softwoods	364	—	—	—	—	—	—	—	—	—	364	—	—	—	—	—
Total softwoods	4,182,205	800,314	998,549	186,255	232,755	39,313	59,507	204,616	136,515	50,904	116,820	132,277	899,507	237,836	74,091	12,946
Hardwoods:																
Select white oaks	264,498	393	—	—	1,904	—	—	—	—	73,869	13,931	54,829	108,456	7,061	4,055	—
Select red oaks	439,583	1,531	2,005	—	—	—	—	—	287	160,774	487	67,701	167,393	38,386	1,019	—
Other red oaks	1,141	—	—	—	—	—	—	—	—	290	—	514	337	—	—	—
Hickory	444	—	—	—	—	—	—	—	—	—	—	—	—	444	—	—
Yellow birch	11,866	—	—	—	—	—	—	—	—	—	2,015	9,060	463	328	—	—
Hard maple	204,393	—	—	1,344	—	—	—	—	—	959	1,928	180,054	16,507	3,000	601	—
Soft maple	75,450	—	—	—	927	—	684	—	—	1,365	22,140	33,644	13,487	3,183	—	—
Ash	352,993	—	—	—	2,037	—	—	3,841	—	1,637	210,127	56,594	51,371	11,780	15,606	—
Balsam poplar	572,553	975	—	—	19,807	750	—	5,283	4,430	1,298	41,705	25,718	215,658	28,791	228,138	—
Paper birch	570,799	3,528	35,931	1,975	23,232	767	1,189	7,467	1,660	13,267	26,129	85,873	195,543	151,677	22,013	548
Bigtooth aspen	213,453	1,181	318	—	—	—	393	—	—	17,490	2,877	16,471	162,112	12,611	—	—
Quaking aspen	2,843,092	13,013	6,922	1,666	26,250	6,216	1,286	3,304	1,711	48,882	29,675	107,168	2,432,631	94,541	64,810	5,017
Basswood	413,860	—	—	1,296	2,946	—	—	—	—	9,496	26,551	285,626	65,003	20,747	2,195	—
Elm	468,485	424	—	—	3,553	—	—	256	811	4,981	119,444	187,246	109,530	19,979	22,261	—
Select hardwoods	2,223	—	—	—	—	—	—	—	—	810	—	440	973	—	—	—
Other hardwoods	3,712	—	—	—	—	—	—	—	—	—	634	3,078	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	21,045	45,176	6,281	80,656	7,733	3,552	20,151	8,899	335,138	497,643	1,114,016	3,539,464	392,528	360,698	5,565
All species	10,620,750	821,359	1,043,725	192,536	313,411	47,046	63,059	224,767	145,414	386,042	614,463	1,246,293	4,438,971	630,364	434,789	18,511

[1]International ¼-inch rule.

Table 26.—*Net volume of growing stock on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	90,495	36,866	—	10,886	729	5,694	9,306	1,042	15,271	—	1,305	8,422	—	974
Red pine	273,024	122,738	2,503	14,041	848	27,079	43,029	11,243	33,042	—	3,125	15,376	—	—
Jack pine	370,689	41,118	9,536	8,864	1,696	67,353	65,318	32,719	87,221	—	6,400	50,464	—	—
White spruce	42,389	3,637	1,360	1,954	861	7,770	8,287	3,177	10,317	—	1,017	4,009	—	—
Black spruce	113,362	9,393	2,847	8,486	2,134	50,159	19,258	3,066	12,166	—	1,225	4,628	—	—
Balsam fir	328,134	84,130	727	10,815	3,192	55,747	73,131	14,689	52,248	—	4,218	28,919	—	318
Tamarack	150,313	7,440	489	17,272	1,356	66,126	22,875	1,926	23,527	—	5,502	3,800	—	—
Northern white-cedar	140,654	25,172	3,508	21,850	1,206	50,250	12,725	2,703	12,980	—	—	10,260	—	—
Other softwoods	394	—	—	—	—	394	—	—	—	—	—	—	—	—
Total softwoods	1,509,454	330,494	20,970	94,168	12,022	330,572	253,929	70,565	246,772	—	22,792	125,878	—	1,292
Hardwoods:														
Select white oaks	119,986	8,109	84	7,188	1,334	8,223	17,828	1,079	54,190	—	2,693	19,175	—	83
Select red oaks	217,524	10,862	—	4,399	2,246	26,082	45,920	3,595	62,362	—	6,831	53,584	—	1,643
Other red oaks	1,015	—	—	—	—	165	58	—	792	—	—	—	—	—
Hickory	520	—	—	—	—	—	185	—	247	—	—	88	—	—
Yellow birch	3,552	—	—	—	—	260	872	473	309	—	399	1,239	—	—
Hard maple	83,680	2,526	—	4,256	1,247	14,968	20,063	3,907	18,353	—	1,870	16,228	—	262
Soft maple	49,757	2,643	—	914	336	6,993	15,855	1,513	10,749	—	1,815	8,939	—	—
Ash	241,200	15,633	1,377	12,195	1,960	46,998	44,123	12,651	64,688	—	6,043	35,532	—	—
Balsam poplar	265,529	13,055	1,091	21,602	3,544	56,738	48,411	10,322	76,519	—	5,007	29,089	—	151
Paper birch	538,764	72,521	713	24,757	7,475	76,673	133,662	20,928	103,141	—	14,581	83,669	—	644
Bigtooth aspen	123,016	5,760	134	2,119	397	21,260	30,029	4,949	25,109	—	5,130	27,864	—	265
Quaking aspen	1,519,243	142,207	9,125	97,872	9,694	280,163	344,064	61,958	343,980	—	47,105	182,306	—	769
Basswood	203,813	24,617	—	13,657	3,104	22,448	44,957	5,692	49,332	—	6,885	32,938	—	183
Elm	141,808	12,071	480	7,910	1,109	12,771	30,053	3,931	56,727	—	3,253	13,460	—	43
Select hardwoods	2,005	—	—	—	139	314	212	—	918	—	211	211	—	—
Other hardwoods	2,028	—	—	62	245	—	118	—	1,446	—	—	157	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	3,513,440	310,004	13,004	196,931	32,830	574,056	776,410	130,998	868,862	—	101,823	504,479	—	4,043
All species	5,022,894	640,498	33,974	291,099	44,852	904,628	1,030,339	201,563	1,115,634	—	124,615	630,357	—	5,335

Table 27.—*Net volume of sawtimber on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods														
White pine	489,804	202,631	—	52,306	3,967	32,741	50,717	6,467	84,543	—	6,598	45,521	—	4,313
Red pine	1,310,295	633,527	3,970	64,106	4,478	117,686	202,497	37,871	154,297	—	13,199	78,664	—	—
Jack pine	952,613	117,014	25,701	25,459	4,972	198,326	166,480	52,927	223,768	—	16,888	121,078	—	—
White spruce	168,448	16,618	7,353	7,176	3,632	25,673	31,283	12,252	41,979	—	5,157	17,325	—	—
Black spruce	87,515	9,305	2,280	3,080	4,123	34,212	17,951	4,953	8,946	—	—	2,665	—	—
Balsam fir	588,296	195,638	1,642	13,561	8,733	88,880	112,960	27,059	82,736	—	6,448	50,111	—	528
Tamarack	210,950	16,402	1,174	17,997	2,771	77,833	34,117	524	46,194	—	7,727	6,211	—	—
Northern white-cedar	373,920	88,109	5,604	35,023	3,828	124,278	35,448	7,735	32,570	—	—	41,325	—	—
Other softwoods	364	—	—	—	—	364	—	—	—	—	—	—	—	—
Total softwoods	4,182,205	1,279,244	47,724	218,708	36,504	699,993	651,453	149,788	675,033	—	56,017	362,900	—	4,841
Hardwoods:														
Select white oaks	264,498	25,896	429	13,597	4,928	20,335	35,446	467	121,644	—	5,716	36,040	—	—
Select red oks	439,583	13,077	—	4,038	5,568	48,605	84,968	2,679	143,085	—	16,458	117,674	—	3,431
Other red oaks	1,141	—	—	—	—	—	290	—	851	—	—	—	—	—
Hickory	444	—	—	—	—	—	444	—	—	—	—	—	—	—
Yellow birch	11,866	—	—	—	—	284	3,373	2,077	328	—	1,347	4,457	—	—
Hard maple	204,393	—	—	8,672	2,303	42,786	47,982	13,840	36,164	—	2,918	49,728	—	—
Soft maple	75,450	463	—	466	606	11,791	25,436	1,493	15,694	—	2,875	16,626	—	—
Ash	352,993	17,470	2,258	15,957	1,744	59,162	72,670	24,236	102,567	—	8,032	48,897	—	—
Balsam poplar	572,553	37,353	1,916	29,854	3,219	124,978	120,966	25,351	161,333	—	12,510	54,192	—	881
Paper birch	570,799	85,509	1,058	36,397	14,510	94,342	97,940	19,429	117,078	—	14,085	90,451	—	—
Bigtooth aspen	213,453	12,135	—	3,166	695	25,028	37,672	13,117	60,066	—	12,532	48,302	—	740
Quaking aspen	2,843,092	298,111	20,611	175,070	19,965	429,499	685,775	121,679	632,456	—	101,013	355,118	—	3,795
Basswood	413,860	36,841	—	31,201	6,912	49,781	79,426	10,243	94,001	—	15,412	89,264	—	779
Elm	468,485	46,860	1,777	22,488	4,316	37,973	91,425	13,438	195,283	—	10,977	43,948	—	—
Select hardwoods	2,223	—	—	—	440	—	—	—	—	—	789	994	—	—
Other hardwoods	3,712	—	—	304	1,204	—	—	—	2,204	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	6,438,545	573,715	28,049	341,210	66,410	944,564	1,383,813	248,049	1,682,754	—	204,664	955,691	—	9,626
All species	10,620,750	1,852,959	75,773	559,918	102,914	1,644,557	2,035,266	397,837	2,357,787	—	260,681	1,318,591	—	14,467

[1]International ¼-inch rule.

Table 28.—*Net volume of growing stock on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	353,872	4,343	2,986	20,706	94,309	101,588	84,422	37,145	7,139	—	1,234	—	—	—
Red pine	231,458	994	516	5,610	9,006	14,155	8,774	14,509	114,819	1,704	59,788	1,583	—	—
White pine	43,072	—	—	—	1,329	10,006	4,608	3,947	2,749	2,625	5,306	12,502	—	—
Balsam fir	161,312	2,491	3,580	13,437	10,153	39,223	32,993	40,370	16,392	1,825	—	848	—	—
White spruce	13,989	—	144	1,004	—	—	7,941	3,491	—	1,409	—	—	—	—
Black spruce	86,562	1,795	2,558	7,850	9,392	10,498	16,678	10,641	5,624	15,847	2,237	1,576	1,866	—
Northern white-cedar	123,094	358	498	2,200	3,011	3,023	11,497	19,881	9,214	15,693	9,597	15,277	30,238	2,607
Tamarack	130,642	1,547	5,909	4,410	5,161	9,630	31,233	8,202	13,618	13,014	5,243	19,230	13,445	—
Oak	201,651	1,290	3,974	1,664	19,374	54,667	45,521	31,903	23,984	5,355	7,739	6,180	—	—
Elm-ash-cottonwood	259,620	3,094	5,056	5,617	7,674	19,569	47,471	37,037	34,551	37,492	33,319	19,102	9,638	—
Maple-basswood	485,862	1,727	4,373	3,463	42,736	89,664	120,435	75,606	51,476	25,148	40,381	6,940	23,913	—
Aspen	2,356,393	74,320	67,559	131,014	460,418	790,310	537,987	193,068	59,499	27,050	9,794	2,885	2,489	—
Paper birch	368,643	963	3,388	5,613	43,923	109,395	95,561	60,944	20,771	16,769	6,320	4,996	—	—
Balsam poplar	199,665	6,099	10,465	12,712	27,979	61,143	42,157	24,678	11,249	3,183	—	—	—	—
Nonstocked	7,059	6,898	—	—	—	161	—	—	—	—	—	—	—	—
All types	5,022,894	105,919	111,006	215,300	734,465	1,313,032	1,087,278	561,422	371,085	167,114	180,958	91,119	81,589	2,607

Table 29.—*Net volume of sawtimber on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	821,359	9,056	5,816	18,688	171,268	230,893	238,642	114,774	28,798	—	3,424	—	—	—
Red pine	1,043,725	4,282	1,196	3,880	27,398	47,095	30,591	59,754	539,862	7,884	314,908	6,875	—	—
White pine	192,536	—	—	—	3,307	37,491	17,127	17,184	12,682	9,885	26,593	68,267	—	—
Balsam fir	313,411	9,404	3,512	22,832	19,103	66,393	60,316	98,463	30,240	803	—	2,345	—	—
White spruce	47,046	—	—	1,557	—	—	24,301	14,935	—	6,253	—	—	—	—
Black spruce	63,059	2,382	1,906	3,745	6,201	9,204	10,047	10,006	4,535	10,708	552	3,773	—	—
Northern white-cedar	224,767	908	—	2,403	2,946	4,942	18,527	20,757	23,693	14,244	13,005	30,242	83,582	9,518
Tamarack	145,414	915	6,430	4,711	1,430	9,369	37,753	8,015	24,051	16,247	6,241	21,693	8,559	—
Oak	386,042	538	10,105	1,478	31,089	58,380	70,951	76,389	72,842	17,730	28,497	18,043	—	—
Elm-ash-cottonwood	614,463	3,853	7,902	5,044	8,530	28,500	106,368	84,940	86,749	105,318	97,515	47,763	31,981	—
Maple-basswood	1,246,293	6,570	5,776	4,664	85,804	147,981	301,541	202,695	164,791	79,309	137,793	23,825	85,544	—
Aspen	4,438,971	148,339	86,406	155,919	623,054	1,392,254	1,244,158	487,252	171,392	81,939	33,741	6,957	7,560	—
Paper birch	630,364	950	4,092	5,768	63,906	139,978	172,153	114,514	45,072	47,897	20,162	15,872	—	—
Balsam poplar	434,789	5,946	17,566	6,081	31,938	120,829	119,527	83,124	37,167	12,611	—	—	—	—
Nonstocked	18,511	18,126	—	—	—	385	—	—	—	—	—	—	—	—
All types	10,620,750	211,269	150,707	236,770	1,075,974	2,293,694	2,452,002	1,392,802	1,241,874	410,828	682,431	245,655	217,226	9,518

[1]International ¼-inch rule.

Table 30.—*Net volume of short-log trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	563	—	—	152	79	—	86	—	246	—	—
Red pine	402	147	—	74	—	109	72	—	—	—	—
Jack pine	2,067	763	481	627	196	—	—	—	—	—	—
White spruce	117	117	—	—	—	—	—	—	—	—	—
Black spruce	421	255	—	—	166	—	—	—	—	—	—
Balsam fir	1,890	835	201	141	65	648	—	—	—	—	—
Tamarack	1,798	1,034	681	83	—	—	—	—	—	—	—
Northern white-cedar	4,140	1,547	1,368	366	384	254	92	41	88	—	—
Other softwoods	203	60	—	—	73	—	70	—	—	—	—
Total softwoods	11,601	4,758	2,731	1,443	963	1,011	320	41	334	—	—
Hardwoods:											
Select white oaks	2,442	—	855	610	446	256	—	275	—	—	—
Select red oaks	4,762	—	1,677	1,670	812	398	87	118	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	575	—	96	301	88	—	—	90	—	—	—
Hard maple	5,387	—	1,197	1,780	1,238	478	341	188	165	—	—
Soft maple	2,164	—	185	190	238	237	340	178	479	317	—
Ash	2,969	—	1,432	436	765	123	—	99	114	—	—
Balsam poplar	2,542	—	1,013	637	400	492	—	—	—	—	—
Paper birch	5,385	—	2,701	1,283	952	345	—	—	104	—	—
Bigtooth aspen	2,472	—	802	867	274	529	—	—	—	—	—
Quaking aspen	36,840	—	16,830	9,473	6,035	2,790	1,008	371	333	—	—
Basswood	2,976	—	961	570	594	337	342	172	—	—	—
Elm	5,431	—	1,432	684	704	504	628	421	592	466	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	73,945	—	29,181	18,501	12,546	6,489	2,746	1,912	1,787	783	—
All species	85,546	4,758	31,912	19,944	13,509	7,500	3,066	1,953	2,121	783	—

Table 31.—*Net volume of short-log trees on commercial forest land by species and diameter class, Northern Pine Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
Softwoods:											
White pine	1,254	—	—	344	179	—	213	—	518	—	—
Red pine	1,039	442	—	169	—	254	174	—	—	—	—
Jack pine	5,962	2,494	1,517	1,508	443	—	—	—	—	—	—
White spruce	754	754	—	—	—	—	—	—	—	—	—
Black spruce	813	595	—	—	218	—	—	—	—	—	—
Balsam fir	4,110	1,824	628	394	194	1,070	—	—	—	—	—
Tamarack	4,638	2,685	1,773	180	—	—	—	—	—	—	—
Northern white-cedar	11,597	5,313	3,489	855	690	575	180	95	400	—	—
Other softwoods	635	303	—	—	165	—	167	—	—	—	—
Total softwoods	30,802	14,410	7,407	3,450	1,889	1,899	734	95	918	—	—
Hardwoods:											
Select white oaks	8,944	—	3,600	2,097	1,301	1,083	—	863	—	—	—
Select red oaks	14,337	—	5,696	4,433	2,598	1,053	101	456	—	—	—
Other red oaks	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	1,822	—	330	880	177	—	—	435	—	—	—
Hard maple	13,800	—	3,189	4,473	2,937	1,143	605	490	963	—	—
Soft maple	6,035	—	758	596	680	627	1,017	434	1,145	778	—
Ash	6,368	—	3,212	1,071	1,431	227	—	193	234	—	—
Balsam poplar	6,141	—	2,702	1,610	867	962	—	—	—	—	—
Paper birch	14,287	—	7,012	3,180	2,732	888	—	—	475	—	—
Bigtooth aspen	6,032	—	1,915	2,135	536	1,446	—	—	—	—	—
Quaking aspen	93,367	—	41,508	23,665	15,570	7,404	2,847	1,173	1,200	—	—
Basswood	7,226	—	2,317	1,368	1,446	859	703	533	—	—	—
Elm	17,996	—	5,910	2,533	2,387	1,845	1,509	1,088	1,572	1,152	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	196,355	—	78,149	48,041	32,662	17,537	6,782	5,665	5,589	1,930	—
All species	227,157	14,410	85,556	51,491	34,551	19,436	7,516	5,760	6,507	1,930	—

[1]International ¼-inch rule.

Table 32.—*Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Northern Pine Unit, Minnesota, 1961 and 1976*
(In thousand cubic feet)

Species	[1]1961	1976
Softwoods	36,286	59,123
Hardwoods	107,007	100,669
All species	143,293	159,792

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 33.—*Net annual growth of growing stock on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods													
White pine	2,779	161	113	554	817	214	128	139	642	2	3	—	6
Red pine	8,742	59	234	1,358	2,311	328	467	679	2,889	180	1	—	236
Jack pine	19,216	134	849	2,156	3,687	299	2,086	3,488	2,547	1,470	39	888	1,573
White spruce	3,228	252	170	580	265	96	77	141	1,202	215	1	301	-72
Black spruce	4,947	448	104	882	321	153	15	116	1,918	739	4	237	10
Balsam fir	13,570	850	409	1,705	2,488	497	230	393	6,368	561	-6	224	-149
Tamarack	2,092	-210	-62	517	473	261	149	131	195	437	33	282	-114
Northern white-cedar	4,527	244	—	1,506	546	21	19	21	1,445	553	—	172	—
Other softwoods	22	10	—	—	4	—	—	—	8	—	—	—	—
Total softwoods	59,123	1,948	1,817	9,258	10,912	1,869	3,171	5,108	17,214	4,157	75	2,104	1,490
Hardwoods													
Select white oaks	3,213	454	244	304	584	225	435	320	184	17	307	32	107
Select red oaks	6,034	427	662	191	1,515	274	1,439	747	529	—	155	—	95
Other red oaks	29	1	10	—	—	—	—	18	—	—	—	—	—
Hickory	12	7	—	—	—	—	5	—	—	—	—	—	—
Yellow birch	85	28	—	8	—	—	12	—	37	—	—	—	—
Hard maple	2,535	822	210	247	233	148	119	49	647	—	60		—
Soft maple	1,813	666	26	111	352	48	224	63	316	—	4	—	3
Ash	3,621	948	237	653	576	13	130	137	424	169	109	154	71
Balsam poplar	9,429	853	284	2,782	166	1,200	37	501	982	1,925	341	960	-602
Paper birch	15,829	1,238	1,053	1,680	3,333	895	1,627	1,330	4,015	369	25	63	201
Bigtooth aspen	341	133	-337	274	374	314	38	770	-587	43	—	—	-681
Quaking aspen	45,739	1,634	4,650	8,246	2,625	5,070	3,494	5,383	8,257	3,280	1,244	1,382	474
Basswood	6,228	1,262	614	773	703	487	277	268	1,263	13	548	5	15
Elm	5,617	398	590	1,145	815	939	153	148	745	100	473	50	61
Select hardwoods	73	9	26	—	3	—	29	2	—	—	4	—	—
Other hardwoods	71	5	24	8	2	5	—	—	4	—	9	2	12
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,669	8,885	8,293	16,422	11,281	9,618	8,019	9,736	16,816	5,916	3,279	2,648	-244
All species	159,792	10,833	10,110	25,680	22,193	11,487	11,190	14,844	34,030	10,073	3,354	4,752	1,246

Table 34.—*Net annual growth of sawtimber on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	14,775	786	424	2,559	5,113	1,101	484	541	3,722	16	—	—	29
Red pine	48,197	336	1,099	5,890	14,685	1,720	1,890	4,112	16,483	964	9	—	1,009
Jack pine	56,971	118	2,705	9,521	12,435	942	4,569	10,028	7,285	3,825	643	2,300	2,600
White spruce	12,764	1,467	598	2,747	1,084	365	128	470	5,439	508	24	309	-375
Black spruce	3,800	129	78	237	241	115	—	195	2,557	130	—	118	—
Balsam fir	36,542	3,139	682	2,940	6,668	1,670	1,133	729	17,357	1,579	17	1,028	-400
Tamarack	5,698	1,177	-1,157	738	1,095	577	267	188	1,730	782	138	163	—
Northern white-cedar	13,517	498	—	3,096	1,643	-10	—	67	5,382	2,479	—	362	—
Other softwoods	664	—	—	—	15	—	—	—	649	—	—	—	—
Total softwoods	192,928	7,650	4,429	27,728	42,979	6,480	8,471	16,330	60,604	10,283	831	4,280	2,863
Hardwoods:													
Select white oaks	9,585	440	2,688	745	2,430	1,128	575	344	304	55	684	62	130
Select red oaks	19,759	1,220	1,864	158	2,692	636	6,663	3,056	1,914	—	544	—	1,012
Other red oaks	3	—	2	—	—	—	—	1	—	—	—	—	—
Hickory	6	—	—	—	—	—	6	—	—	—	—	—	—
Yellow birch	166	39	—	7	—	—	43	—	77	—	—	—	—
Hard maple	6,239	2,780	497	854	215	187	513	30	1,115	—	48	—	—
Soft maple	3,278	1,801	6	776	131	74	432	27	31	—	—	—	—
Ash	5,340	-1,005	225	1,036	2,740	675	802	88	-60	533	131	85	90
Balsam poplar	25,742	2,898	1,159	7,009	2,050	2,464	27	487	4,928	3,555	499	1,108	-442
Paper birch	26,074	2,665	1,521	2,478	5,380	2,361	3,341	607	6,878	768	252	-177	—
Bigtooth aspen	10,651	658	942	1,209	3,288	1,228	2,289	1,964	-927	—	—	—	—
Quaking aspen	157,084	9,235	8,012	17,633	22,409	15,379	12,779	11,525	44,496	9,729	3,335	2,150	402
Basswood	12,042	3,300	1,325	1,667	1,737	796	268	82	2,120	68	615	14	50
Elm	18,524	2,838	513	3,229	1,785	4,032	198	79	3,647	280	1,757	27	139
Select hardwoods	444	420	—	—	—	—	24	—	—	—	—	—	—
Other hardwoods	287	7	23	18	224	—	—	—	—	—	15	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	295,224	27,296	18,777	36,819	45,081	28,960	27,960	18,290	64,523	14,988	7,880	3,269	1,381
All species	488,152	34,946	23,206	64,547	88,060	35,440	36,431	34,620	125,127	25,271	8,711	7,549	4,244

[1]International ¼-inch rule.

Table 35.—*Net annual growth of growing stock on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods:														
White pine	2,779	1,025	—	420	-20	163	333	44	457	—	48	272	—	37
Red pine	8,742	3,361	158	499	14	953	1,379	674	1,105	—	119	480	—	—
Jack pine	19,216	1,433	409	542	307	3,133	3,346	2,506	4,390	—	837	2,313	—	—
White spruce	3,228	188	75	152	40	791	657	277	738	—	55	255	—	—
Black spruce	4,947	441	110	372	80	2,128	924	130	529	—	14	219	—	—
Balsam fir	13,570	4,548	29	405	104	2,317	2,504	459	1,950	—	148	1,095	—	11
Tamarack	2,092	212	9	356	37	892	583	65	-344	—	168	114	—	—
Northern white-cedar	4,527	758	123	866	38	1,639	302	104	450	—	—	247	—	—
Other softwoods	22	—	—	—	—	22	—	—	—	—	—	—	—	—
Total softwoods	59,123	11,966	913	3,612	600	12,038	10,028	4,259	9,275	—	1,389	4,995	—	48
Hardwoods:														
Select white oaks	3,213	178	2	197	24	217	491	39	1,432	—	76	553	—	4
Select red oaks	6,034	388	—	158	54	529	1,304	121	1,574	—	193	1,668	—	45
Other red oaks	29	—	—	—	—	3	16	—	10	—	—	—	—	—
Hickory	12	—	—	—	—	—	3	—	7	—	—	2	—	—
Yellow birch	85	—	—	—	—	7	18	10	10	—	10	30	—	—
Hard maple	2,535	83	—	144	31	541	245	104	563	—	213	606	—	5
Soft maple	1,813	76	—	45	10	212	522	68	434	—	67	379	—	—
Ash	3,621	159	32	343	42	959	515	-159	650	—	151	929	—	—
Balsam poplar	9,429	227	201	1,344	428	2,590	1,101	-231	2,115	—	285	1,364	—	5
Paper birch	15,829	1,938	25	616	184	1,953	3,526	964	3,348	—	511	2,747	—	17
Bigtooth aspen	341	-1	7	69	13	782	-899	-564	309	—	169	449	—	7
Quaking aspen	45,739	5,288	411	2,584	306	10,192	6,685	430	11,883	—	1,164	6,782	—	14
Basswood	6,228	778	—	349	87	526	1,702	193	1,420	—	202	967	—	4
Elm	5,617	389	23	411	54	411	1,361	172	2,537	—	149	107	—	3
Select hardwoods	73	—	—	—	3	15	9	—	38	—	5	3	—	—
Other hardwoods	71	—	—	1	5	—	4	—	55	—	—	6	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,669	9,503	701	6,261	1,241	18,937	16,603	1,147	26,385	—	3,195	16,592	—	104
All species	159,792	21,469	1,614	9,873	1,841	30,975	26,631	5,406	35,660	—	4,584	21,587	—	152

Table 36.—*Net annual growth of sawtimber on commercial forest land by species and ownership class, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Softwoods														
White pine	14,775	6,388	—	1,716	–131	879	1,590	251	2,570	—	219	1,182	—	111
Red pine	48,197	18,918	932	3,157	99	4,228	8,680	2,395	6,265	—	478	3,045	—	—
Jack pine	56,971	7,045	1,903	53	88	9,883	10,488	4,417	15,312	—	257	7,525	—	—
White spruce	12,764	921	401	283	170	2,070	1,895	711	4,204	—	306	1,803	—	—
Black spruce	3,800	1,155	45	69	120	487	461	104	1,351	—	—	8	—	—
Balsam fir	36,542	13,652	49	215	155	5,961	5,745	1,165	5,579	—	–112	4,117	—	16
Tamarack	5,698	813	19	63	77	2,620	1,324	14	427	—	181	160	—	—
Northern white-cedar	13,517	4,300	105	1,044	76	5,012	793	1,040	431	—	—	716	—	—
Other softwoods	664	—	—	—	—	664	—	—	—	—	—	—	—	—
Total softwoods	192,928	53,192	3,454	6,600	654	31,804	30,976	10,097	36,139	—	1,329	18,556	—	127
Hardwoods														
Select white oaks	9,585	699	8	215	66	350	1,413	6	5,540	—	101	1,187	—	—
Select red oaks	19,759	488	—	457	413	1,871	3,551	764	5,232	—	350	6,568	—	65
Other red oaks	3	—	—	—	—	—	1	—	2	—	—	—	—	—
Hickory	6	—	—	—	—	—	6	—	—	—	—	—	—	—
Yellow birch	166	—	—	—	—	5	44	24	7	—	25	61	—	—
Hard maple	6,239	—	—	704	40	1,121	572	611	2,085	—	61	1,045	—	—
Soft maple	3,278	5	—	8	9	567	418	20	1,216	—	46	989	—	—
Ash	5,340	1,021	35	274	20	3,269	1,175	–1,323	–1,081	—	152	1,798	—	—
Balsam poplar	25,742	1,606	711	2,522	86	6,151	6,248	515	6,416	—	406	1,053	—	28
Paper birch	26,074	3,930	5	1,411	658	1,678	4,178	2,182	6,711	—	338	4,983	—	—
Bigtooth aspen	10,651	1,533	—	811	13	2,344	–662	793	2,240	—	274	3,293	—	12
Quaking aspen	157,084	18,254	1,832	7,769	1,083	23,578	31,867	6,634	33,989	—	3,814	28,209	—	55
Basswood	12,042	2,433	—	1,002	132	393	2,518	225	2,550	—	272	2,502	—	15
Elm	18,524	1,613	56	1,223	150	314	5,127	692	7,157	—	319	1,873	—	—
Select hardwoods	444	—	—	—	2	—	—	—	410	—	14	18	—	—
Other hardwoods	287	—	—	4	23	—	—	—	36	—	—	224	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	295,224	31,582	2,647	16,400	2,695	41,641	56,456	11,143	72,510	—	6,172	53,803	—	175
All species	488,152	84,774	6,101	23,000	3,349	73,445	87,432	21,240	108,649	—	7,501	72,359	—	302

[1]International ¼-inch rule.

Table 37.—*Net annual growth of growing stock on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods																
White pine	2,779	58	892	644	43	17	2	1	30	39	11	112	673	249	8	—
Red pine	8,742	1,595	4,183	322	90	22	—	—	13	181	6	19	1,916	382	13	
Jack pine	19,216	15,935	384	82	43	75	11	2	22	251	10	5	2,085	255	56	—
White spruce	3,228	148	91	45	284	346	35	27	36	–56	55	113	1,786	183	135	
Black spruce	4,947	215	18	13	597	5	2,973	171	543	—	15	4	323	39	27	4
Balsam fir	13,570	108	454	49	2,964	76	166	33	93	25	173	623	6,824	1,127	654	201
Tamarack	2,092	5	5	—	–64	3	179	208	2,143	4	–221	13	–45	–167	21	7
Northern white-cedar	4,527	—	—	—	419	19	165	2,810	107	—	639	50	375	–126	66	3
Other softwoods	22	—	—	—	—	—	10	—	—	—	4	—	—	—	8	—
Total softwoods	59,123	18,064	6,028	1,155	4,376	563	3,541	3,252	2,987	444	692	939	13,937	1,942	968	215
Hardwoods																
Select white oaks	3,213	30	8	5	18	1	—	—	—	793	98	286	1,764	173	37	—
Select red oaks	6,034	94	21	3	3	—	3	—	1	2,205	21	307	2,694	673	9	—
Other red oaks	29	—	—	—	—	—	—	—	—	1	—	1	26	1	—	—
Hickory	12	—	—	—	—	—	—	—	—	5	—	4	—	3	—	—
Yellow birch	85	—	—	—	—	—	—	—	—	—	15	51	5	14	—	—
Hard maple	2,535	—	—	3	—	—	—	—	—	41	174	1,616	530	141	30	—
Soft maple	1,813	4	3	2	16	—	3	—	6	133	112	399	939	190	6	—
Ash	3,621	2	5	—	138	—	7	71	13	53	1,504	764	916	71	76	—
Balsam poplar	9,429	33	36	4	107	29	11	85	110	36	242	419	2,231	195	5,975	84
Paper birch	15,829	408	377	75	240	8	26	113	58	557	254	795	7,294	5,367	223	34
Bigtooth aspen	341	–576	–120	—	2	—	84	—	—	159	28	140	964	–346	6	—
Quaking aspen	45,739	620	286	32	328	80	128	–48	75	324	242	623	41,057	377	1,547	68
Basswood	6,228	5	—	11	25	—	—	—	—	368	237	3,686	1,549	343	4	—
Elm	5,617	8	3	—	46	—	6	1	43	138	630	1,900	2,027	505	310	—
Select hardwoods	73	—	—	—	—	—	—	—	—	29	—	11	26	7	—	—
Other hardwoods	71	12	4	—	—	—	—	—	—	4	5	31	15	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,669	640	624	135	923	118	268	222	306	4,846	3,562	11,033	62,037	7,714	8,223	18
All species	159,792	18,704	6,652	1,290	5,299	681	3,809	3,474	3,293	5,290	4,254	11,972	75,974	9,656	9,211	233

Table 38.—*Net annual growth of sawtimber on commercial forest land by species and forest type, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All types	Forest type: Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Softwoods																
White pine	14,775	193	5,741	3,468	234	96	10	12	149	199	60	593	2,746	1,227	47	—
Red pine	48,197	6,091	25,750	1,591	459	52	—	—	61	558	—	106	11,372	2,094	63	—
Jack pine	56,971	41,494	590	107	137	181	22	2	38	322	—	8	13,527	517	26	—
White spruce	12,764	157	32	129	904	681	41	13	85	-365	736	336	8,293	682	1,040	—
Black spruce	3,800	102	—	26	1,201	23	850	-94	158	—	13	—	1,433	31	44	13
Balsam fir	36,542	86	1,500	53	6,008	599	525	363	87	14	-420	5,041	17,599	1,283	2,944	860
Tamarack	5,698	24	10	—	266	19	881	110	4,586	26	-708	25	381	-390	434	34
Northern white-cedar	13,517	—	—	—	2,488	55	834	4,066	801	—	2,810	142	2,338	-216	187	12
Other softwoods	664	—	—	—	—	—	—	—	—	—	15	—	—	—	649	—
Total softwoods	192,928	48,147	33,623	5,374	11,697	1,706	3,163	4,472	5,965	754	2,506	6,251	57,689	5,228	5,434	919
Hardwoods:																
Select white oaks	9,585	7	—	—	36	—	—	—	—	1,666	266	1,804	5,088	660	58	—
Select red oaks	19,759	37	43	—	—	—	—	—	5	5,352	7	1,795	9,702	2,798	20	—
Other red oaks	3	—	—	—	—	—	—	—	—	1	—	1	1	—	—	—
Hickory	6	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—
Yellow birch	166	—	—	—	—	—	—	—	—	—	33	119	7	7	—	—
Hard maple	6,239	—	—	17	—	—	—	—	—	15	32	4,377	1,295	491	12	—
Soft maple	3,278	—	—	—	19	—	9	—	—	29	358	461	2,321	81	—	—
Ash	5,340	—	—	—	30	—	—	40	—	27	1,845	1,431	314	681	972	—
Balsam poplar	25,742	42	—	—	877	14	—	115	130	29	595	1,288	5,940	2,290	14,422	—
Paper birch	26,074	1,058	1,597	16	-174	8	11	41	9	627	571	3,120	12,712	6,544	-73	7
Bigtooth aspen	10,651	26	5	—	—	—	7	—	—	307	51	1,337	8,641	277	—	—
Quaking aspen	157,084	65	135	-1,158	1,177	103	459	32	29	1,614	470	3,624	145,519	586	4,335	94
Basswood	12,042	—	—	25	52	—	—	—	—	395	1,133	7,451	1,997	945	44	—
Elm	18,524	13	—	—	96	—	—	3	29	424	4,797	5,490	6,466	569	637	—
Select hardwoods	444	—	—	—	—	—	—	—	—	425	—	2	17	—	—	—
Other hardwoods	287	—	—	—	—	—	—	—	—	—	11	276	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	295,224	1,248	1,780	-1,100	2,113	125	486	231	202	10,911	10,169	32,576	200,020	15,935	20,427	101
All species	488,152	49,395	35,403	4,274	13,810	1,831	3,649	4,703	6,167	11,665	12,675	38,827	257,709	21,163	25,861	1,020

[1]International ¼-inch rule

Table 39.—*Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Forest type	All classes	Stand-age class (years): 0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	18,704	93	11	2,447	5,378	4,910	3,744	1,854	231	—	36	—	—	—
Red pine	6,652	57	35	564	438	620	378	479	2,965	48	1,021	47	—	—
White pine	1,290	—	—	—	88	605	-5	152	146	67	37	200	—	—
Balsam fir	5,299	83	182	461	418	1,369	1,052	1,068	560	76	—	30	—	—
White spruce	681	—	16	76	—	—	416	124	—	49	—	—	—	—
Black spruce	3,809	60	109	293	505	477	738	461	219	703	107	40	97	—
Northern white-cedar	3,474	14	21	113	65	65	363	593	210	621	375	290	662	82
Tamarack	3,293	50	247	118	203	387	549	274	162	321	78	618	286	—
Oak	5,290	67	145	63	723	1,408	1,394	663	592	148	95	-8	—	—
Elm-ash-cottonwood	4,254	-152	150	118	283	802	690	219	181	1,028	560	156	219	—
Maple-basswood	11,972	-132	147	133	1,561	2,405	3,288	1,825	1,096	118	846	175	510	—
Aspen	75,974	-666	3,728	7,921	16,437	25,924	15,796	4,365	1,670	666	-13	85	61	—
Paper birch	9,656	52	132	260	935	3,486	2,088	1,871	619	-63	167	109	—	—
Balsam poplar	9,211	716	552	1,239	1,792	2,172	1,503	802	340	95	—	—	—	—
Nonstocked	233	225	—	—	—	8	—	—	—	—	—	—	—	—
All types	159,792	467	5,475	13,806	28,826	44,638	31,994	14,750	8,991	3,877	3,309	1,742	1,835	82

Table 40.—*Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years) 0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	49,395	–572	700	1,823	13,999	19,955	7,982	4,400	1,046	—	62	—	—	—
Red pine	35,403	219	27	274	1,022	1,979	1,946	2,337	18,831	214	8,403	151	—	—
White pine	4,274	—	—	—	664	1,323	–480	617	516	231	196	1,207	—	—
Balsam fir	13,810	250	96	530	1,546	3,173	2,100	2,348	3,679	19	—	69	—	—
White spruce	1,831	—	—	48	—	—	696	923	—	164	—	—	—	—
Black spruce	3,649	50	43	77	348	734	1,746	270	91	211	13	66	—	—
Northern white-cedar	4,703	24	—	35	–213	–9	503	1,143	522	746	273	180	1,306	193
Tamarack	6,167	20	527	118	26	1,748	2,163	163	–509	1,056	138	536	181	—
Oak	11,665	14	231	33	1,460	2,029	3,993	2,250	1,900	554	57	–856	—	—
Elm-ash-cottonwood	12,675	–394	153	–291	209	2,119	836	–1,148	3,194	4,047	3,060	–19	909	—
Maple-basswood	38,827	112	619	88	3,678	4,704	11,277	6,562	5,914	168	3,166	847	1,692	—
Aspen	257,709	–484	7,265	16,030	41,980	100,050	70,640	10,082	7,013	4,392	508	103	130	—
Paper birch	21,163	62	3	147	–571	8,239	7,158	4,325	1,946	–1,123	739	238	—	—
Balsam poplar	25,861	262	179	162	2,610	9,457	6,807	5,138	893	353	—	—	—	—
Nonstocked	1,020	007	—	—	—	13	—	—	—	—	—	—	—	—
All types	488,152	570	9,843	19,074	66,758	155,514	117,367	39,410	45,036	11,032	16,615	2,522	4,218	193

[1]International ¼-inch rule.

Table 41.—*Timber removals from growing stock and sawtimber on commercial forest land by species, Northern Pine Unit, Minnesota, 1962 and 1976*

Species	Growing stock 1962	Growing stock 1976	Sawtimber 1962	Sawtimber 1976
	Thousand cubic feet		*Thousand board feet*[1]	
Softwoods:				
White pine	1,368	1,013	7,643	5,026
Red pine	2,235	2,540	10,289	10,535
Jack pine	10,269	10,259	29,073	27,943
Spruce	4,818	4,723	10,473	10,493
Balsam fir	4,750	6,040	8,342	11,563
Tamarack	1,935	2,126	3,493	4,523
Northern white-cedar	993	1,801	1,268	3,568
Other softwoods	—	—	—	—
Total softwoods	26,368	28,502	70,581	73,651
Hardwoods:				
White oak	554	595	1,330	1,729
Red oak	1,178	1,988	2,554	4,597
Yellow birch	90	8	423	17
Hard maple	254	319	462	676
Soft maple	97	269	222	558
Ash	750	1,237	2,241	3,353
Paper birch	1,714	4,540	3,726	6,257
Aspen	20,982	32,642	41,066	82,174
Basswood	592	805	2,653	2,768
Elm	495	1,050	1,567	4,073
Other hardwoods	343	1,473	889	2,553
Total hardwoods	27,049	44,926	57,133	108,755
All species	53,417	73,428	127,714	182,406

[1]International ¼-inch rule.

Table 42.— *Timber removals from growing stock on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods													
White pine	1,013	60	82	233	162	23	14	37	361	16	12	—	13
Red pine	2,540	40	96	346	805	94	171	84	693	22	21	—	168
Jack pine	10,259	178	500	1,400	1,964	692	606	1,114	1,190	451	183	1,247	734
White Spruce	1,265	82	32	183	34	84	3	18	540	148	17	116	8
Black Spruce	3,458	112	16	525	80	268	—	23	1,213	834	3	381	3
Balsam Fir	6,040	284	121	1,137	344	209	38	38	3,642	123	21	76	7
Tamarack	2,126	345	18	403	90	523	26	84	449	45	22	113	8
Northern white-cedar	1,801	97	—	240	140	48	2	5	907	217	1	143	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	28,502	1,198	865	4,467	3,619	1,941	860	1,404	8,995	1,856	280	2,076	941
Hardwoods:													
Select white oak	595	44	62	33	93	61	59	23	52	6	131	10	21
Select red oak	1,980	595	136	70	374	77	214	87	275	5	87	8	52
Other red oak	8	1	6	—	—	—	—	1	—	—	—	—	—
Hickory	5	—	—	—	5	—	—						
Yellow birch	8	1	—	1	1	—	—	—	5	—	—	—	—
Hard maple	319	48	24	25	52	27	14	19	67	—	38	—	5
Soft maple	269	53	1	6	61	3	47	18	77	—	3	—	—
Ash	1,237	325	37	84	98	10	106	19	174	54	37	277	16
Balsam poplar	1,455	54	18	255	54	52	—	12	202	416	170	222	—
Paper birch	4,540	431	146	755	912	171	146	286	1,168	129	148	169	79
Quaking aspen	30,440	4,075	458	4,703	3,267	984	1,073	2,300	9,770	1,830	837	891	252
Basswood	805	90	83	192	43	18	75	6	87	1	170	15	25
Elm	1,050	84	98	96	41	110	46	7	282	27	113	106	40
Other hardwoods	13	—	1	—	1	—	—	5	—	—	1	4	1
Total hardwoods	44,926	5,987	1,145	6,384	5,465	1,599	2,016	3,134	12,769	2,490	1,735	1,702	500
All species	73,428	7,185	2,010	10,851	9,084	3,540	2,876	4,538	21,764	4,346	2,015	3,778	1,441

Table 43.— *Timber removals from sawtimber on commercial forest land by species and county, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All counties	Aitkin	Becker	Beltrami	Cass	Clearwater	Crow Wing	Hubbard	Itasca	Lake of the Woods	Mahnomen	Roseau	Wadena
Softwoods:													
White pine	5,026	302	416	1,156	824	92	69	208	1,738	92	62	—	67
Red pine	10,535	200	357	1,387	3,503	351	735	245	2,701	107	105	—	844
Jack pine	27,943	511	1,722	3,641	5,144	1,811	1,774	2,997	2,826	1,457	507	3,584	1,969
White Spruce	6,224	299	76	1,049	148	406	6	51	2,686	863	34	590	16
Black Spruce	4,269	75	20	470	81	370	—	38	1,414	1,289	2	508	2
Balsam Fir	11,563	438	162	2,370	741	383	53	69	6,963	210	27	120	27
Tamarack	4,523	731	35	866	184	1,145	55	178	943	97	41	238	10
Northern white-cedar	3,568	182	—	524	301	92	1	9	1,736	480	—	243	—
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	73,651	2,738	2,788	11,463	10,926	4,650	2,693	3,795	21,007	4,595	778	5,283	2,935
Hardwoods:													
Select white oak	1,729	141	242	67	210	279	257	41	80	13	283	22	94
Select red oak	4,587	946	534	181	772	216	893	126	442	8	270	12	187
Other red oak	10	—	9	—	—	—	—	1	—	—	—	—	—
Hickory	9	1	—	—	7	—	1	—	—	—	—	—	—
Yellow birch	17	2	—	2	3	—	—	—	10	—	—	—	—
Hard maple	676	129	73	51	78	60	49	27	102	—	83	—	24
Soft maple	558	169	1	8	84	4	118	26	144	—	4	—	—
Ash	3,353	1,341	122	184	148	12	516	26	509	65	45	330	55
Balsam poplar	2,522	93	30	491	91	89	1	20	393	649	288	376	1
Paper birch	6,257	657	216	722	1,248	233	339	298	1,982	137	160	163	102
Bigtooth aspen	5,473	768	146	440	1,110	167	614	389	1,826	13	—	—	—
Quaking aspen	76,701	10,674	1,097	10,558	8,137	2,650	3,056	5,458	27,126	3,678	1,581	1,766	920
Basswood	2,768	366	403	548	118	47	362	11	377	2	382	25	127
Elm	4,073	391	434	340	87	503	225	12	1,324	61	257	242	197
Other hardwoods	22	—	2	—	2	—	—	8	1	—	2	6	1
Total hardwoods	108,755	15,678	3,309	13,592	12,095	4,260	6,431	6,443	34,316	4,626	3,355	2,942	1,708
All species	182,406	18,416	6,097	25,055	23,021	8,910	9,124	10,238	55,323	9,221	4,133	8,225	4,643

[1]International ¼-inch rule.

Table 44.—*Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Northern Pine Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						*Thousand board feet*[1]					
Roundwood Products:												
Pulpwood	32,901	5,409	3,693	5,638	16,349	1,812	70,845	10,901	8,266	12,527	38,035	1,116
Saw logs	13,914	2,893	264	2,484	6,083	2,190	66,385	14,423	1,311	13,959	24,861	11,831
Fuelwood	3,519	282	—	39	743	2,455	4,916	392	—	66	1,034	3,424
Posts	721	365	—	330	16	10	366	155	—	139	34	38
Veneer logs	32	—	—	—	1	31	229	—	—	—	9	220
Poles	372	192	—	180	—	—	1,075	557	—	518	—	—
Other[2]	2,943	48	—	41	2,714	140	10,285	226	—	192	8,962	905
All products	54,402	9,189	3,957	8,712	25,906	6,638	154,101	26,654	9,577	27,401	72,935	17,534
Logging residue:	1,974	207	74	201	996	496	2,544	193	5	271	773	1,302
Other removals:	17,052	863	692	4,607	5,740	5,150	25,761	1,096	911	7,543	8,466	7,745
Total removals	73,428	10,259	4,723	13,520	32,642	12,284	182,406	27,943	10,493	35,215	82,174	26,581

[1]International ¼-inch rule.
[2]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 45.—*Timber removals from growing stock by ownership class and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National forest	5,790	1,883	3,907
Other federal	3,656	2,242	1,414
State	16,139	8,662	7,477
County	9,393	3,204	6,189
Forest industry	4,549	2,387	2,162
Farmer and miscellaneous private	33,901	10,124	23,777
All ownerships	73,428	28,502	44,926

Table 46.—*Timber removals from sawtimber by ownership class and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Ownership class	All species	Softwoods	Hardwoods
National forest	14,86	5,963	8,901
Other federal	9,11	5,566	3,553
State	43,66	24,429	19,239
County	25,49	8,853	16,643
Forest industry	11,02	5,293	5,733
Farmer and miscellaneous private	78,23	23,547	54,686
All ownerships	182,406	73,651	108,775

[1]International ¼-inch rule.

Table 47.—*Annual mortality of growing stock on commercial forest land by species and cause, Northern Pine Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All causes	Cause										
		Insects	Disease	Fire	Animals	Weather	Supression	Logging	Timber stand improvement	Land clearing	Conversion	Unknown and other
Softwoods:												
White pine	256	—	217	39	—	—	—	—	—	—	—	—
Red pine	110	—	—	—	—	59	—	13	—	—	—	38
Jack pine	1,641	70	577	278	112	131	—	12	—	—	—	461
White spruce	149	—	4	—	26	105	—	—	—	—	—	14
Black spruce	461	—	144	—	50	103	—	—	—	—	—	164
Balsam fir	4,345	311	1,285	—	76	1,345	19	51	—	45	—	1,213
Tamarack	2,528	211	684	—	86	451	—	—	—	—	—	1,096
Northern white-cedar	528	—	231	—	—	84	—	—	—	—	—	213
Other softwoods	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	10,018	592	3,142	317	350	2,278	19	76	—	45	—	3,199
Hardwoods:												
Select white oaks	327	—	327	—	—	—	—	—	—	—	—	—
Select red oaks	1,078	—	103	—	—	569	—	—	—	—	—	406
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	496	—	496	—	—	—	—	—	—	—	—	—
Soft maple	246	—	65	—	—	181	—	—	—	—	—	—
Ash	2,502	—	895	—	—	1,391	—	—	—	—	—	216
Balsam poplar	5,486	—	3,475	84	—	1,262	—	—	—	—	—	665
Paper birch	2,308	80	1,500	—	—	351	—	53	—	—	—	324
Bigtooth aspen	3,789	—	2,017	—	—	—	—	—	—	—	—	1,772
Quaking aspen	34,375	612	21,899	3,567	1,111	6,278	—	—	—	—	—	908
Basswood	723	—	232	—	—	272	—	104	—	—	—	115
Elm	1,184	—	634	—	—	—	—	7	—	—	—	543
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Non-commercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	52,514	692	31,643	3,651	1,111	10,304	—	164	—	—	—	4,949
All species	62,532	1,284	34,785	3,968	1,461	12,582	19	240	—	45	—	8,148

Table 48.—*Annual mortality of growing stock on commercial forest land by species and cause, Northern Pine Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All causes	Cause										
		Insects	Disease	Fire	Animals	Weather	Supression	Logging	Timber stand improvement	Land clearing	Conversion	Unknown and other
Softwoods:												
White pine	1,287	—	1,049	238	—	—	—	—	—	—	—	—
Red pine	345	—	—	—	—	157	—	—	—	—	—	188
Jack pine	4,417	344	2,251	135	390	258	—	70	—	—	—	969
White spruce	541	—	—	—	60	481	—	—	—	—	—	—
Black spruce	209	—	51	—	—	58	—	—	—	—	—	100
Balsam fir	8,446	904	1,925	—	112	2,815	—	143	—	—	—	2,547
Tamarack	3,915	—	2,374	—	—	—	—	—	—	—	—	1,541
Northern white-cedar	1,596	—	872	—	—	205	—	—	—	—	—	519
Other softwood	—	—	—	—	—	—	—	—	—	—	—	—
Total softwoods	20,756	1,248	8,522	373	562	3,974	—	213	—	—	—	5,864
Hardwoods:												
Select white oaks	—	—	—	—	—	—	—	—	—	—	—	—
Select red oaks	3,409	—	—	—	—	2,308	—	—	—	—	—	1,101
Other red oaks	—	—	—	—	—	—	—	—	—	—	—	—
Hickory	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	1,003	—	1,003	—	—	—	—	—	—	—	—	—
Soft maple	906	—	—	—	—	906	—	—	—	—	—	—
Ash	5,470	—	—	—	—	5,470	—	—	—	—	—	—
Balsam poplar	15,657	—	9,710	—	—	4,229	—	—	—	—	—	1,718
Paper birch	4,834	—	3,382	—	—	766	—	293	—	—	—	393
Bigtooth aspen	3,712	—	3,712	—	—	—	—	—	—	—	—	—
Quaking aspen	60,773	—	34,175	5,381	4,088	17,129	—	—	—	—	—	—
Basswood	1,790	—	885	—	—	905	—	—	—	—	—	—
Elm	3,151	—	3,151	—	—	—	—	—	—	—	—	—
Select hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—
Total hardwoods	100,705	—	56,018	5,381	4,088	31,713	—	293	—	—	—	3,212
All species	121,461	1,248	64,540	5,754	4,650	35,687	—	506	—	—	—	9,076

[1]International ¼-inch rule.

Table 49.—*Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National forest	4,623	620	4,003	7,796	1,498	6,298
Bureau of land mgmt.	—	—	—	—	—	—
Indian	3,343	563	2,780	7,303	1,994	5,309
Miscellaneous federal	221	78	143	875	388	487
State	9,231	2,592	6,639	19,405	3,163	16,242
County and municipal	18,956	1,907	17,049	32,781	3,712	29,069
Forest industry	4,883	420	4,463	7,994	536	7,458
Farmer	14,309	2,977	11,332	30,707	7,244	23,463
Farmer-owned leased	—	—	—	—	—	—
Misc. private-corp.	1,503	202	1,301	3,270	553	2,717
Misc. private-indiv.	5,463	659	4,804	11,330	1,668	9,662
Misc. priv.-corp., leased	—	—	—	—	—	—
Misc. priv.-ind., leased	—	—	—	—	—	—
All owners	62,532	10,018	52,514	121,461	20,756	100,705

[1]International ¼-inch rule.

Table 50.— *Output of timber products by source of material and softwoods and hardwoods, Northern Pine Unit, Minnesota, 1975*

Product and species group	Standard unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*
Pulpwood:	Standard cords[1]								
Softwood		206,222	16,287	186,641	14,740	11,092	876	8,489	671
Hardwood		307,562	24,296	229,899	18,161	31,584	2,495	46,079	3,640
Total		513,784	40,583	416,540	32,901	42,676	3,371	54,568	4,311
Fuelwood:	Standard cords[1]								
Softwood		14,955	1,023	4,735	321	6,166	418	4,054	284
Hardwood		112,533	7,840	45,915	3,198	60,215	4,194	6,403	448
Total		127,488	8,863	50,650	3,519	66,381	14,612	10,457	732
Posts:	Thousand pieces								
Softwood		1,062	851	867	695	195	156	—	—
Hardwood		59	34	45	26	14	8	—	—
Total		1,121	885	912	721	209	164	—	—
Veneer logs:	Thousand board feet[2]								
Softwood		—	—	—	—	—	—	—	—
Hardwood		241	33	234	32	7	1	—	—
Total		241	33	234	32	7	1	—	—
Poles:	Pieces								
Softwood		63,212	377	62,374	372	838	5	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		63,212	377	62,374	372	838	5	—	—
Saw logs:	Thousand board feet[2]								
Softwood		31,558	5,800	30,693	5,641	865	159	—	—
Hardwood		46,597	8,466	45,535	8,273	1,062	193	—	—
Total		78,155	14,266	76,228	13,914	1,927	352	—	—
Others[3]:	Thousand cubic feet								
Softwood		230	230	89	89	—	—	141	141
Hardwood		3,307	3,307	2,854	2,854	298	298	155	155
Total		3,537	3,537	2,943	2,943	298	298	296	296
All products:	Thousand cubic feet								
Softwood		24,568	24,568	21,858	21,858	1,614	1,614	1,096	1,096
Hardwood		43,976	43,976	32,544	32,544	7,189	7,189	4,243	4,243
Total		68,544	68,544	54,402	54,402	8,803	8,803	5,339	5,339

[1]Rough-wood, 128 cubic feet basis.
[2]International ¼-inch rule.
[3]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.—*Forest products harvested, by ownership class and product, Northern Pine Unit, Minnesota, 1975*

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*Thousand board feet*[2]	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
Federal:						
National forest:						
Softwoods	13,227	3,686	3,151	—	700	14
Hardwoods	26,235	1,703	32,516	—	—	605
Total	39,462	5,389	35,667	—	700	619
Other federal:						
Softwoods	20,986	1,827	115	99	4,700	2
Hardwoods	8,749	1,874	769	—	—	38
Total	29,735	3,701	884	99	4,700	40
State:						
Softwoods	75,105	11,839	684	340	12,465	23
Hardwoods	49,417	9,972	5,290	2	—	354
Total	24,522	21,811	5,974	342	12,465	377
County:						
Softwoods	26,145	4,171	661	32	—	10
Hardwoods	44,845	7,704	5,207	—	—	744
Total	70,990	11,875	5,868	32	—	754
Private:						
Forest industry:						
Softwoods	27,857	664	71	116	—	16
Hardwoods	20,448	2,670	427	—	—	109
Total	48,305	3,334	498	116	—	125
Farm and other:						
Softwoods	34,413	9,371	6,219	475	45,347	24
Hardwoods	111,789	22,674	61,921	57	—	1,335
Total	146,202	32,045	68,140	532	45,437	1,359
All owners:						
Softwoods	197,733	31,558	10,901	1,062	63,212	89
Hardwoods	261,483	46,597	106,130	59	—	3,185
Total	459,216	78,155	117,031	1,121	63,212	3,274

[1]Standard cords, rough wood, 128 cubic feet basis.
[2]International ¼-inch rule.

Table 52.— *Volume of primary plant residue, by kind of material and type of use, Northern Pine Unit, Minnesota, 1975*

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	470.7	1,651.5	414.7	1,487.4	56.0	164.1	—	—
Industrial fuel	—	91.5	—	1.9	—	89.6	146.8	100.9
Domestic fuel	283.8	356.7	274.3	352.0	9.5	4.7	124.8	191.7
Charcoal	57.6	59.1	57.6	59.1	—	—	35.9	38.2
Miscellaneous[5]	83.0	95.8	26.9	28.3	56.1	67.5	12.5	73.3
Not used[6]	941.9	1,306.6	391.4	310.5	550.5	996.1	596.7	1,203.9
Total	1,837.0	3,561.2	1,164.9	2,239.2	672.1	1,322.0	916.7	1,608.0

[1]Suitable for chipping such as slabs, edging, veneer cores, etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Does not include bark disposal at pulpmills.
[4]For manufacture of pulp, hardboard or roofing felt.
[5]Livestock bedding, mulch, small dimension, and speciality items.
[6]Includes residue burned as waste.

Table 53.— *Timber products output from roundwood, by species and product, Northern Pine Unit, Minnesota, 1975*

Species	All products	Saw logs		Veneer logs		Pulpwood		Fuelwood		Poles		Posts		Other products
	Thousand cubic feet[1]	Thousand board feet[2]	Thousand cubic feet[1]	Thousand board feet[2]	Thousand cubic feet[1]	Thousand cords	Thousand cubic feet[1]	Cords	Thousand cubic feet[1]	Pieces	Thousand cubic feet[1]	Thousand pieces	Thousand cubic feet[1]	Thousand cubic feet[1]
Softwoods:														
White pine	894	4,633	798	—	—	1,158	92	126	4	—	—	—	—	—
Red pine	2,137	8,333	1,435	—	—	4,014	316	336	17	30,472	182	191	152	35
Jack pine	10,161	15,671	3,009	—	—	73,505	5,804	9,305	654	32,740	195	559	451	48
Spruce	4,155	1,424	274	—	—	49,141	3,881	—	—	—	—	—	—	—
Balsam fir	3,737	955	181	—	—	44,845	3,543	252	13	—	—	—	—	—
Tamarack	2,073	70	13	—	—	25,070	1,980	840	51	—	—	39	29	—
Northern white-cedar	315	472	90	—	—	—	—	42	—	—	—	273	219	6
Total softwoods	23,472	31,558	5,800	—	—	197,733	15,616	10,901	739	63,212	377	1,062	851	89
Hardwoods:														
White oak	414	924	153	—	—	—	—	3,739	257	—	—	8	—	4
Red oak	2,447	2,567	428	38	5	5,816	460	21,547	1,508	—	—	14	6	40
Hickory	13	—	—	—	—	—	—	210	13	—	—	—	—	—
Yellow birch	14	—	—	6	1	3	—	210	13	—	—	—	—	—
Hard maple	405	210	34	29	4	159	11	5,075	356	—	—	—	—	—
Soft maple	341	256	45	15	2	19	—	4,201	294	—	—	—	—	—
Ash	754	2,424	424	1	—	55	5	4,671	321	—	—	11	4	—
Balsam poplar	138	196	33	—	—	917	73	559	32	—	—	—	—	—
Paper birch	4,607	1,615	282	105	16	18,225	1,440	39,947	2,794	—	—	—	—	75
Aspen	29,607	33,435	6,193	10	1	236,246	18,665	24,601	1,723	—	—	26	24	3,001
Basswood	364	1,828	321	31	4	—	—	181	7	—	—	—	—	32
Elm	629	3,142	553	6	—	41	2	1,147	74	—	—	—	—	—
Other hardwoods	—	—	—	—	—	2	—	42	—	—	—	—	—	—
Total hardwoods	39,733	46,597	8,466	241	33	261,483	20,656	106,130	7,392	—	—	59	34	3,152
All species	63,205	78,155	14,266	241	33	459,216	36,272	117,031	8,131	63,212	377	1,121	885	3,241

[1]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.
[2]International ¼-inch rule.

Table 54.—*Sampling errors*[1] *for estimates smaller than Unit totals of volume, net growth, and removals and of area of commercial forest land in Minnesota's Northern Pine Unit, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	*Thousand acres*	*Million cubic feet*			*Million board feet*		
1	2,722.5	9,859.6	518.4	2,093.0	91,776.4	4,243.6	3,372.6
2	680.6	2,464.9	129.6	523.3	22,944.1	1,060.9	843.1
3	302.5	1,096.2	57.6	232.6	10,195.3	472.0	374.7
4	170.6	616.2	32.4	130.8	5,736.0	265.2	210.8
5	108.9	394.4	20.7	83.7	3,671.1	169.7	134.9
10	27.2	98.6	5.2	20.9	917.8	42.4	33.7
15	12.1	43.7	2.3	9.3	408.3	18.8	15.0
20	6.9	24.7	1.3	5.2	229.4	10.6	8.4
25	4.4	15.9	0.8	3.3	146.7	6.7	5.4
50	1.1	4.0	0.2	0.8	36.9	1.7	1.3
100	0.3	1.0	0.1	0.2	9.2	0.4	0.3

[1]At the 68 percent probability level.

☆U.S. GOVERNMENT PRINTING OFFICE: 1980-668-876/221 REG.#6

Jakes, Pamela J., and Gerhard K. Raile.

1980. Timber Resource of Minnesota's Northern Pine Unit, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-44, 54 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

The fourth inventory of Minnesota's Northern Pine Unit shows a 28 percent increase in growing-stock inventory, but a 4 percent decrease in commercial forest area between 1962 and 1977. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

OXFORD: 905(776). KEY WORDS: timber volume, growth, utilization, forest areas.

Jakes, Pamela J., and Gerhard K. Raile.

1980. Timber Resource of Minnesota's Northern Pine Unit, 1977. U.S. Dep. Agric. For. Serv., Resour. Bull. NC-44, 54 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.

The fourth inventory of Minnesota's Northern Pine Unit shows a 28 percent increase in growing-stock inventory, but a 4 percent decrease in commercial forest area between 1962 and 1977. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

OXFORD: 905(776). KEY WORDS: timber volume, growth, utilization, forest areas.

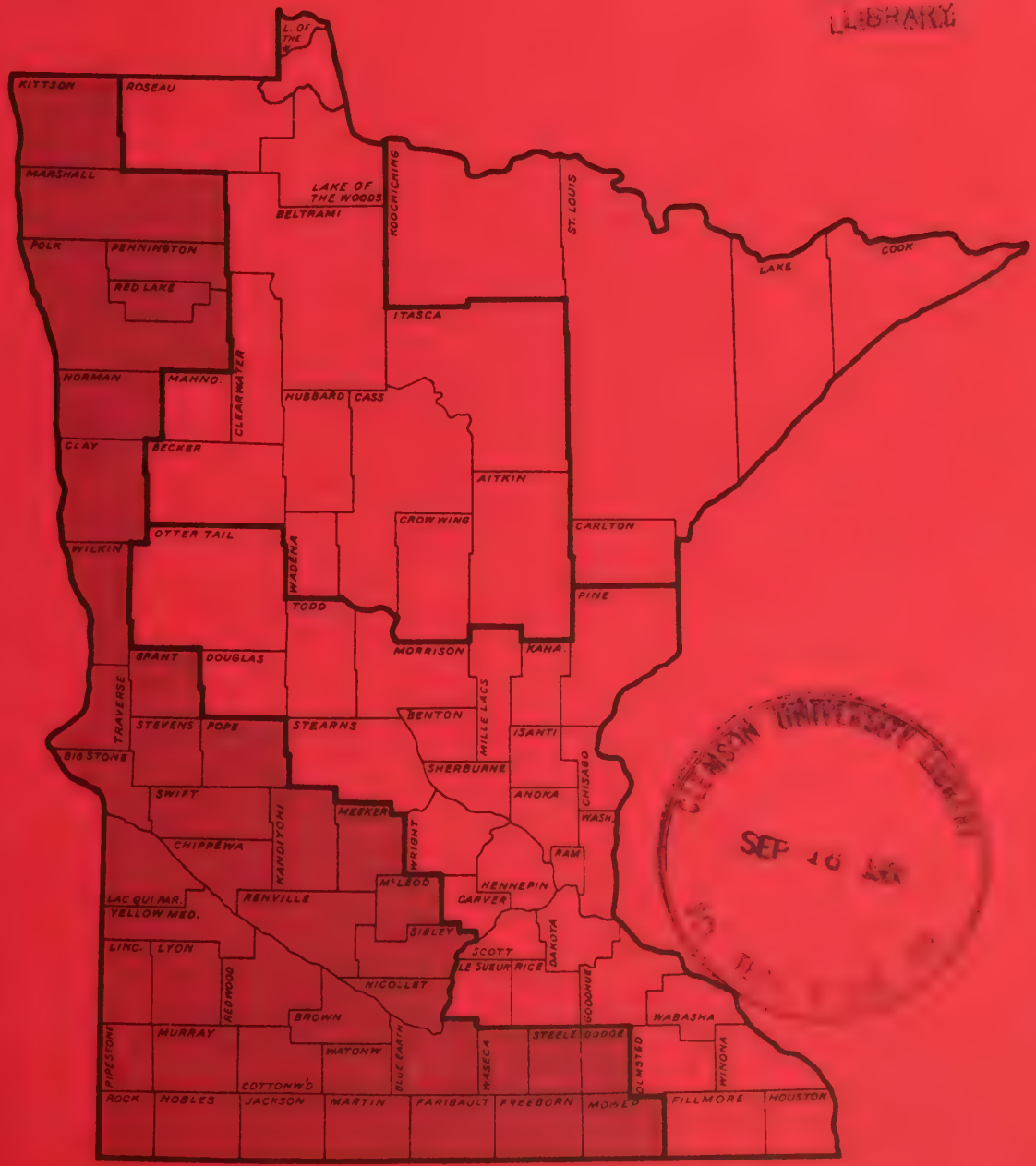
Give a hoot...don't pollute!

DA FOREST SERVICE
ESOURCE BULLETIN NC-45

Timber resource of Minnesota's prairie unit, 1977.

GOVT. DOCUMENTS
DEPOSITORY ITEM
SEP 11 1980
CLEMSON
LIBRARY

Jerold T. Hahn and W. Brad Smith



CLEMSON UNIVERSITY LIBRARY
SEP 16

orth Central Forest Experiment Station
orest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication June 25, 1977

1980

FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974, which was preceeded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July 1974 and was completed in July 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are also available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Prairie Unit survey were furnished by the USDA Agricultural Stabilization and Conservation Service.

CONTENTS

Page

Highlights 1
Tables 2
Principal Tree Species in Minnesota's Prairie Unit 4
Appendix 5
- Accuracy of Survey 5
- Survey Procedures 5
- Comparing Minnesota's Fourth Forest Survey with the Third Survey 6
- Metric equivalents of units used in this report 6
- Definition of terms 7

TIMBER RESOURCE OF MINNESOTA'S PRAIRIE UNIT, 1977

Jerold T. Hahn, *Principal Mensurationist,*
and **W. Brad Smith,** *Associate Mensurationist*

HIGHLIGHTS

Forest Area

- Forest land area declined 37 percent between 1962[1] and 1977—from 922,300 to 581,500 acres.
- Commercial forest land totaled 534,200 acres in 1977, a 32 percent decline from the 782,500 acres in 1962.
- Only 3 percent of the Unit's land area is forest land. Most (88 percent) of the Unit's land is classified as cropland without trees.
- Farmers own 395,900 acres of commercial forest land (74 percent of the total) (fig.1).
- The predominant forest types are aspen, which covers 253,000 acres (47 percent of the total), and maple-basswood, which covers 117,200 acres (22 percent).
- Commercial forest area is fairly evenly divided among sawtimber stands (180,600 acres), poletimber stands (178,700 acres), and sapling and seedling stands (169,000 acres), with only 5,900 acres of nonstocked areas.
- The Unit has 38,600 acres of unproductive forest land.

[1]*1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix.)*

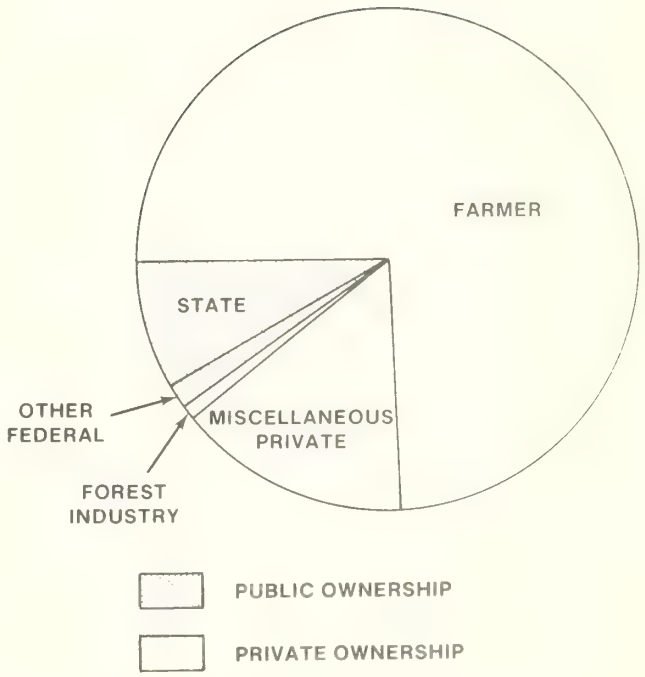


Figure 1—*Distribution of commercial forest land by ownership class, Prairie Unit, Minnesota, 1977.*

Timber Volume

- Net volume of timber is 428.8 million cubic feet—362.2 million cubic feet of growing-stock trees, 66.1 million cubic feet of cull trees, and 0.5 million cubic feet of salvable dead trees.
- Growing-stock volume rose 22 percent from 296.7 million cubic feet in 1962 to 362.2 million cubic feet in 1977 (fig. 2).

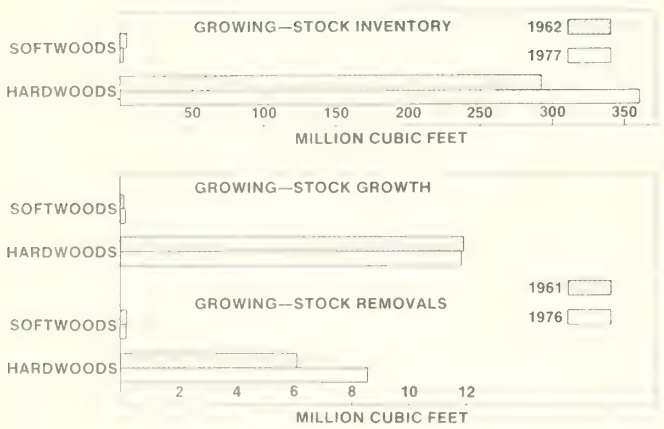


Figure 2.—Growing-stock inventory, net annual growth, and removals, by softwoods and hardwoods, Prairie Unit, Minnesota, 1962 to 1977.

- Ninety-nine percent of the growing-stock volume is hardwoods; quaking aspen, select white oaks, and elm are the most common species.
- Sawtimber volume is 1.1 billion board feet, up 62 percent since 1962.
- The average growing-stock volume per acre of commercial forest land is 678 cubic feet.

Stand Condition

- Net annual growth of growing-stock trees totaled 11.9 million cubic feet. The growth rate was 3.3 percent of inventory.
- Average annual cubic foot mortality was 6.2 million cubic feet, or 1.7 percent of inventory.
- Fifty-eight percent of the Unit's growing-stock volume is more than 50 years old.
- The average productive potential for the Unit is 48 cubic feet of growing-stock growth per acre per year.

Timber Use

- Timber removals[2] totaled 8.7 million cubic feet in 1976 as compared to 6.2 million cubic feet in 1962.
- Of the 8.7 million cubic feet harvested, 2.1 million cubic feet were for products, 6.5 million cubic were other removals, and 0.2 million cubic feet were logging residue.
- The volume of primary plant residue totaled 302,300 cubic feet.

TABLES

Area:

1. Area of land by land class, 1962 and 1977.
2. Area by land class and county.
3. Area of commercial forest land by county and ownership class.
4. Area of commercial forest land by county and forest type.
5. Area of commercial forest land by county and site index class.
6. Area of commercial forest land by county and stand-size class.
7. Area of commercial forest land by site and ownership class.
8. Area of commercial forest land by forest type and ownership class.
9. Area of commercial forest land by forest type and stand-age class.
10. Area of commercial forest land by forest type, stand-size, and site class.
11. Area of noncommercial forest land by ownership class.
12. Area of noncommercial forest land by forest type.

[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included in 1976 removals.*

Number of trees:

13. Number of all live trees on commercial forest land by species and diameter class.

14. Number of growing-stock trees on commercial forest land by species and diameter class.

15. Number of short-log trees on commercial forest land by species and diameter class.

Volume:

16. Net volume of growing stock and sawtimber on commercial forest land by species, 1962 and 1977.

17. Cubic foot volume in all live trees on commercial forest land by species and diameter class.

18. Net volume of timber on commercial forest land by class of timberand softwoods and hardwoods.

19. Net volume of growing stock on commercial forest land by species and county.

20. Net volume of sawtimber on commercial forest land by species and county.

21. Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species.

22. Net volume of growing stock on commercial forest land by species and diameter class.

23. Net volume of sawtimber on commercial forest land by species and diameter class.

24. Net volume of growing stock on commercial forest land by species and forest type.

25. Net volume of sawtimber on commercial forest land by species and forest type.

26. Net volume of growing stock on commercial forest land by species and ownership class.

27. Net volume of sawtimber on commercial forest land by species and ownership class.

28. Net volume of growing stock on commercial forest land by forest type and stand-age class.

29. Net volume of sawtimber on commercial forest land by forest type and stand-age class.

30. Net volume of short-log trees on commercial forest land by species and diameter class (in cubic feet).

31. Net volume of short-log trees on commercial forest land by species and diameter class (in board feet).

Growth:

32. Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, 1961 and 1976.

33. Net annual growth of growing stock on commercial forest land by species and county.

34. Net annual growth of sawtimber on commercial forest land by species and county.

35. Net annual growth of growing stock on commercial forest land by species and ownership class.

36. Net annual growth of sawtimber on commercial forest land by species and ownership class.

37. Net annual growth of growing stock on commercial forest land by species and forest type.

38. Net annual growth of sawtimber on commercial forest land by species and forest type.

39. Net annual growth of growing stock on commercial forest land by forest type and stand-age.

40. Net annual growth of sawtimber on commercial forest land by forest type and stand-age.

Timber removals:

41. Timber removals from growing stock and sawtimber on commercial forest land by species, 1962 and 1976.

42. Timber removals from growing stock on commercial forest land by species and county.

43. Timber removals from sawtimber on commercial forest land by species and county.

44. Timber removals from growing stock and sawtimber on commercial forest land by item and species group.

45. Timber removals from growing stock by ownership class and softwoods and hardwoods.

46. Timber removals from sawtimber by ownership class and softwoods and hardwoods.

Mortality:

47. Annual mortality of growing stock on commercial forest land by species and cause.

48. Annual mortality of sawtimber on commercial forest land by species and cause.

49 Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods.

Utilization

50. Output of timber products by source of material and softwoods and hardwoods.

51. Forest products harvested by ownership class and product.

52. Volume of primary plant residue by kind of material and type of use.

53. Timber products output from roundwood by species and product.

Text table:

54. Sampling errors for estimates smaller than Unit totals of volume, net growth, removals, and area of commercial forest land.

PRINCIPAL TREE SPECIES IN MINNESOTA'S PRAIRIE UNIT[3]

SOFTWOOD SPECIES

Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Other softwoods:
Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES

White oaks:
  White oak ..... *Quercus alba*
  Bur oak ..... *Quercus macrocarpa*
Select red oaks:
  Northern red oak ..... *Quercus rubra*
Other red oaks:
  Northern pin oak ..... *Quercus ellipsoidalis*
Hickories:
Bitternut hickory ..... *Carya cordiformis*
Shagbark hickory ..... *Carya ovata*
Yellow birch ..... *Betula alleghaniensis*
Hard maples:
Sugar maple ..... *Acer saccharum*
Soft maples:
Red maple ..... *Acer rubrum*
Silver maple ..... *Acer saccharinum*
Ashes:
White ash ..... *Fraxinus americana*
Black ash ..... *Fraxinus nigra*
Green ash ..... *Fraxinus pennsylvanica*
Balsam poplar ..... *Populus balsamifera*
Paper birch ..... *Betula papyrifera*
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Basswood ..... *Tilia americana*
Elms:
American elm ..... *Ulmus americana*
Slippery elm ..... *Ulmus rubra*
Rock elm ..... *Ulmus thomasii*
Select hardwoods:
Butternut ..... *Juglans cinerea*
Blackwalnut ..... *Juglans nigra*
Black cherry ..... *Prunus serotina*
Other hardwoods:
Boxelder ..... *Acer negundo*
Hackberry ..... *Celtis occidentalis*
Kentucky coffeetree ..... *Gymnocladus dioicus*
Eastern cottonwood ..... *Populus deltoides*
Black willow ..... *Salix nigra*

[3]*The common and scientific names are based on: Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Prairie Unit in 1977, 534,200 acres, has a sampling error of ± 3.12 percent (± 16,700 acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would fall between 517,500 and 550,900 acres (534,200 ± 16,700).

The following sampling errors are for total estimated volume, net growth, and removals for both growing stock and sawtimber, and for area of commercial forest land during the 1977 Prairie Unit survey:

Item	Aspen-Birch Unit totals	Sampling error (percent)
Growing stock:		
Volume	362.2 million cubic feet	4.91
Growth	11.9 million cubic feet	5.79
Removals	8.7 million cubic feet	11.56
Sawtimber:		
Volume	1.1 billion board feet	7.80
Growth	39.3 million board feet	9.00
Removals	17.9 million board feet	11.86
Commercial forest land:	534,200 acres	3.12

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURE

The major steps in the survey of the Prairie Unit were as follows:

1. A total of 102,869 1-acre points distributed systematically across aerial photos of the entire area, were observed. To make a preliminary estimate of forest area, these points were classified as either forest land (3,745), unproductive forest land (11), nonforest land (98,993), or questionable (120). Next, all 3,745 of the forest points and all 120 of the questionable points were stereoclassified as to forest type, stand-size class, and density. Then 495 points classed as forest, 16 points classed as questionable, and 13,469 points classed as nonforest were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 13,469 commercial forest locations, 10 variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated using the Forest Resources Evaluation Program (FREP)[4]; which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

3. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to

[4]*For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. NC-49, 96 p. U.S. Dep. Agric. For. Serv., North Cent. For. Exp. Stn., St. Paul, MN.*

determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of all public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

4. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

5. Field data were sent to St. Paul, Minnesota, for compilation.

COMPARING MINNESOTA'S FOURTH SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

In Minnesota's Prairie Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys and changes in survey methods. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area. However, because 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes.

A test was made to ensure that it was possible to move from 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so that changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commercial forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys reflected actual change and not merely a change in the volume equations used on each occasion.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000 board feet (International-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, flood plains, streams, sloughs, and estuaries. Canals less than 1/8-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation, or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than l acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annually, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased.—Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.—Land owned by a private individual but leased to another party.

Tree Classes

All live trees.—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that may kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.—Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more than 6 inches and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully stocked stands.—Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.—Stands in which stocking of trees is from 60 to 100 percent.

Poorly stocked stands.—Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-size Classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimber trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

White pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of the live-tree stocking, with black spruce the most common.

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of live-tree stocking, with northern white-cedar the most common.

Tamarack.—Forests in which swamp conifers comprise a plurality of live-tree stocking, with tamarack the most common.

Oak.—Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.—Forests in which lowland elm, ash, cottonwood and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.—Net volume of the saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.—That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.—Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the

year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year,

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

The annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year, and

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Mortality of growing stock.—The volume of sound wood in growing-stock trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber.—The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock.—The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts, or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.—Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Prairie Unit, Minnesota, 1962 and 1977*

(In thousand acres)

Land class	[1]1962	1977
COMMERCIAL FOREST LAND:		
Jack pine	—	—
Red pine	—	—
White pine	—	—
Balsam fir	—	—
White spruce	—	—
Black spruce	3.2	—
Northern white-cedar	6.5	—
Tamarack	10.0	1.0
Oak-hickory	59.2	69.3
Elm-ash-cottonwood	250.4	55.1
Maple-basswood	94.1	117.2
Aspen	328.2	253.0
Paper birch	—	—
Balsam poplar	—	32.7
Nonstocked	30.9	5.9
Subtotal	782.5	534.2
NONCOMMERCIAL FOREST LAND:		
Unproductive	136.3	38.6
Productive-reserved	3.5	8.7
Subtotal	139.8	47.3
NONFOREST LAND:	18,347.5	18,555.6
Total	19,269.8	19,137.1

[1]Figures have been adjusted from those published after 1962 survey to conform to 1977 areas because of changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Prairie Unit, Minnesota, 1977*
(In thousand acres)

Land class	All counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cotton-wood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyohi	Kittson	Lac qui Parle	Lincoln
FOREST LAND																
Commercial	534.2	2.4	21.4	9.1	3.9	10.3	2.5	6.4	6.2	4.8	2.9	2.1	9.9	67.5	4.6	2.0
Productive-reserved	8.7	0.1	0.3	0.6	—	0.4	—	—	—	0.2	—	—	0.7	0.2	0.4	—
Unproductive	38.6	0.2	1.9	1.0	0.1	0.5	0.1	1.0	0.3	0.7	0.1	0.2	1.8	4.2	0.2	0.2
Total	581.5	2.7	23.6	10.7	4.0	11.2	2.6	7.4	6.5	5.7	3.0	2.3	12.4	71.9	5.2	2.2
NONFOREST LAND																
Nonforest with trees																
Cropland with trees	9.5	—	0.6	0.2	0.1	0.1	—	0.3	0.1	0.1	0.1	—	0.6	0.7	—	—
Improved pasture with trees	5.9	—	0.4	0.1	0.1	0.2	—	0.1	0.1	0.1	0.1	—	0.2	0.5	—	—
Wooded strips	24.3	0.1	1.6	0.4	0.3	0.9	0.1	0.5	0.2	0.3	0.3	0.1	0.7	2.5	0.1	0.1
Idle farmland with trees	1.0	—	—	—	0.1	—	—	—	0.1	—	0.1	—	—	—	—	—
Windbreaks	22.1	—	1.6	—	0.7	0.8	—	0.3	0.6	—	0.5	—	0.8	1.0	—	—
Wooded pasture	9.1	—	0.2	0.1	0.2	—	0.1	—	0.3	—	0.1	—	0.1	1.2	0.1	—
Subtotal	71.9	0.1	4.4	0.8	1.5	2.0	0.2	1.2	1.4	0.5	1.2	0.1	2.4	5.9	0.2	0.1
Nonforest without trees																
Cropland without trees	16,838.5	287.1	404.3	347.9	333.9	597.6	371.7	246.1	409.3	403.8	316.5	411.3	453.4	572.8	444.0	306.5
Improved pasture without trees	143.3	2.4	3.5	3.0	2.8	4.9	3.1	2.0	3.5	3.3	2.6	3.4	3.7	5.5	3.8	2.5
Idle farmland without trees	3.6	—	—	—	—	—	—	—	—	—	—	—	—	1.6	—	—
Marsh	498.6	8.0	11.1	9.5	9.1	16.7	9.9	6.7	11.0	11.0	8.5	11.0	12.6	24.6	11.9	8.2
Other farm-farmstead	274.6	4.6	7.0	5.6	5.5	9.2	6.1	3.7	6.9	6.0	4.8	6.3	7.2	9.5	7.4	4.8
Urban and other	687.3	8.9	15.6	12.0	15.1	23.4	13.4	10.9	16.5	17.7	10.4	11.1	8.1	26.8	13.8	14.6
Noncensus water	37.8	—	1.8	0.8	0.3	4.1	—	0.4	—	0.4	2.6	—	1.4	0.4	5.3	0.9
Subtotal	18,483.7	311.0	443.3	378.8	366.7	655.9	404.2	269.8	447.2	442.2	345.4	443.1	486.4	641.2	486.2	337.5
Total	18,555.6	311.1	447.7	379.6	368.2	657.9	404.4	271.0	448.6	442.7	346.6	443.2	488.8	647.1	486.4	337.6
Total land area[1]	19,137.1	313.8	471.3	390.3	372.2	669.1	407.0	278.4	455.1	448.4	349.6	445.5	501.2	719.0	491.6	339.8
Census water	324.0	20.3	10.6	5.2	2.2	4.2	5.8	—	4.4	11.1	17.7	13.4	50.5	0.4	4.4	6.4
TOTAL GROSS AREA	19,461.1	334.1	481.9	395.5	374.4	673.3	412.8	278.4	459.5	459.5	367.3	458.9	551.7	719.4	496.0	346.2

[1]International ¼-inch rule.

(Table 2 continued on next page)

(Table 2 continued)

Land class	Lyon	McLeod	Marshall	Martin	Meeker	Mower	Murray	Nicollet	Nobles	Norman	Pennington	Pipestone	Polk	Pope	Red Lake	Redwood	Renville	Rock
FOREST LAND																		
Commercial	4 4	5 8	128.5	3 6	10 8	5 2	1 1	12 3	0 7	22 2	30 7	0 4	68 0	6 9	27 2	6 2	7 2	0 5
Productive-reserved	0.6	—	3.5	—	—	0 2	0 2	0 4	—	—	—	—	—	0.3	0 1	—	0 1	—
Unproductive	0 3	0 3	10 7	0 2	1 2	0 7	0 1	1 0	—	0 9	1 3	—	3 3	0 6	1 6	0 5	0 7	—
Total	5 3	6 1	142 7	3 8	12 0	6 1	1 4	13 7	0 7	23 1	32 0	0 4	71 3	7 8	28 9	6 7	8 0	0 5
NONFOREST LAND																		
Nonforest with trees																		
Croplandwithtrees	—	—	1 5	0 1	1 7	0 2	—	0 4	—	0 3	0 2	—	0 6	0 2	0 1	0 1	0 1	—
Improved pasture withtrees	—	—	0 8	0 1	0 8	0 1	—	0 4	—	0 2	0 1	—	0 4	0 1	—	0 1	0 1	—
Wooded strips	0.2	0 1	4 7	0 2	1 5	0 4	—	0 7	—	0.8	0 6	—	2 2	0 5	0 5	0 3	0 3	—
Idle farmland with trees	—	—	0 1	0 1	—	0 1	—	0 1	—	—	—	—	—	0 1	—	—	—	—
Windbreaks	0 1	—	3 2	0 4	2 8	0 6	—	1 0	—	0.5	0 2	—	1 6	0 8	—	0 4	—	—
Wooded pasture	0 1	—	1 6	0 2	—	0 2	—	0 3	—	0 9	0 5	—	1 2	0 3	0 2	0 2	0.1	—
Subtotal	0 4	0 1	11 9	1 1	6.8	1 6	—	2 9	—	2.7	1 6	—	6 0	2 0	0 8	1 1	0 6	—
Nonforest without trees																		
Cropland without trees	409 0	281 6	866 9	410 4	336 2	403 5	412 7	241 0	417 5	492 4	330 3	271 8	1,091 2	380 1	221 5	503 8	565 8	283 1
Improved pasture without trees	3 5	2 4	7 9	3 4	2 8	3 4	3 4	2 2	3 5	4 2	2 9	2.2	9 8	3 1	2 0	4 2	4 8	2 3
Idle farmland without trees	—	—	1 6	—	—	—	—	—	—	0 1	0.1	—	—	—	0 2	—	—	—
Marsh	11 0	7 5	49 2	11 0	9 5	10 9	11 0	6.5	11 2	14 1	10.2	7 3	33 1	10 8	7 8	13 7	15 2	7 6
Other farm-farmstead	6 7	4 4	14 8	6 6	5 1	6 1	6 4	4 3	6 3	9 4	6 3	4 1	20 0	6 0	4 3	8 1	9 0	4 3
Urban and other	17 4	9 6	47 9	13 8	23 2	17 7	15 0	4 8	16 3	20 1	14 3	11 2	50 3	15 3	11 0	21 6	22 9	12 6
Noncensus water	0 2	0 6	2 2	—	0 7	0 6	—	1 3	—	0 3	0 3	—	6 4	3 2	—	0 2	—	—
Subtotal	447 8	306 1	990 5	445 2	377 5	442 2	448 5	260 1	454 8	540 6	364 4	296.6	1,210.8	418 5	246.8	551 6	617 7	309 9
Total	448 2	306 2	1,002 4	446.3	384 3	443 8	448.5	263 0	454 8	543 3	366 0	296 6	1 216 8	420.5	247 6	552 7	618.3	309 9
Total land area[1]	453 5	312 3	1,145 1	450.1	396.3	449 9	449 9	276.7	455 5	566.4	398 0	297 0	1,288 1	428 3	276.5	559 4	626 3	310 4
Census water	4 7	9 6	6 9	15 2	13 3	—	11 5	17 1	4 7	—	0.1	—	9 8	31 2	—	—	2 2	—
TOTAL GROSS AREA	458 2	321 9	1,152 0	465 3	409 6	449 9	461 4	293 8	460 2	566.4	398.1	297 0	1 297 9	459 5	276.5	559 4	628 5	310 4

(Table 2 continued on next page)

(Table 2 continued)

Land class	Sibley	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
FOREST LAND									
Commercial	10 9	5 0	1 0	4 7	0 9	4 6	1.1	0 5	7 8
Productive-reserved	—	0 1	—	0 1	—	—	—	—	0 2
Unproductive	1 0	0 5	—	0 2	—	0 4	—	—	0 6
Total	11 9	5 6	1 0	5 0	0 9	5 0	1 1	0 5	8 6
NONFOREST LAND									
Nonforest with trees:									
Cropland with trees	0 1	0 5	0 1	—	—	0 3	—	—	0 1
Improved pasture with trees	0 1	0 3	0 1	—	—	0 2	—	—	0 1
Wooded strips	1 3	0 6	0 2	0 1	0 1	0 4	—	—	0 4
Idle farmland with trees	—	0 1	0 1	—	—	—	—	—	—
Windbreaks	1 3	1 3	0 8	—	—	0.4	—	—	0 4
Wooded pasture	0 1	0 2	0.2	0 1	—	—	—	—	0 3
Subtotal	2 9	3 0	1.5	0 2	0 1	1 3	—	—	1 3
Nonforest without trees:									
Cropland without trees	323 5	240 7	326.8	429 5	331 5	237 5	252 5	440 5	431 0
Improved pasture without trees	2 8	2 0	2 7	3 6	2 7	2 0	2 2	3 6	3 7
Idle farmland without trees	—	—	—	—	—	—	—	—	—
Marsh	8 8	6 5	8.8	11 7	8 9	6 4	6 7	11 8	11 6
Other farm-farmstead	5 3	3.8	5.0	7.1	5 0	3 7	4 0	6.6	7 3
Urban and other	17 1	10 7	10.8	15 7	14 0	9 4	10 4	17 6	18.3
Noncensus water	0.9	—	0.6	0.4	0 6	—	—	0 5	0.4
Subtotal	358 4	263.7	354 7	468 0	362 7	259.0	275 8	480 6	472 3
Total	361 3	266.7	356 2	468 2	362 8	260 3	275 8	480 6	473 6
Total land area[1]	373.2	272.3	357.2	473.2	363 7	265 3	276.9	481 1	482 2
Census water	4 4	1.0	9.5	5 5	8.1	6.7	2 8	0 2	2.9
TOTAL GROSS AREA	377.6	273.3	366.7	478 7	371 8	272 0	279.7	481.3	485.1

Table 3.—*Area of commercial forest land by county and ownership class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

County	All owners	Ownership class							
		Misc. federal	State	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Big Stone	2.4	0.1	0.2	—	1.9	—	0.2	—	—
Blue Earth	21.4	—	0.4	—	17.2	0.2	3.5	—	0.1
Brown	9.1	—	—	—	7.5	0.2	1.3	—	0.1
Chippewa	3.9	0.1	0.3	—	3.0	0.1	0.4	—	—
Clay	10.3	0.1	0.4	0.1	8.7	0.1	0.9	—	—
Cottonwood	2.5	—	0.1	—	2.0	—	0.4	—	—
Dodge	6.4	—	—	—	5.1	0.2	1.1	—	—
Faribault	6.2	—	0.3	—	5.1	—	0.7	—	0.1
Freeborn	4.8	—	0.1	—	3.9	0.1	0.7	—	—
Grant	2.9	—	—	—	2.5	—	0.4	—	—
Jackson	2.1	—	—	—	1.7	—	0.4	—	—
Kandiyohi	9.9	0.1	0.2	—	8.5	0.2	0.9	—	—
Kittson	67.5	1.4	10.0	0.6	43.7	0.7	10.9	0.2	—
Lac qui Parle	4.4	—	0.3	—	3.7	—	0.5	—	0.1
Lincoln	2.0	—	—	—	1.6	—	0.4	—	—
Lyon	4.4	—	0.3	—	3.5	—	0.7	—	0.1
McLeod	5.8	—	0.1	—	4.7	—	1.0	—	—
Marshall	128.5	4.0	18.7	1.3	85.9	1.2	16.4	1.0	—
Martin	3.6	—	—	—	2.8	—	0.7	—	0.1
Meeker	10.8	0.1	0.1	—	8.3	0.2	2.1	—	—
Mower	5.2	—	—	—	4.1	0.1	1.0	—	—
Murray	1.1	—	0.2	—	0.8	—	0.1	—	—
Nicollet	12.3	—	0.1	—	9.7	—	2.4	—	0.1
Nobles	0.7	—	—	—	0.6	—	0.1	—	—
Norman	22.2	0.3	1.2	0.1	17.2	0.1	3.1	—	0.2
Pennington	30.7	0.6	2.7	0.2	23.0	0.1	3.9	0.1	0.1
Pipestone	0.4	—	—	—	0.3	—	0.1	—	—
Polk	68.0	1.4	4.9	0.6	53.4	0.3	7.0	0.2	0.2
Pope	6.9	0.2	0.4	—	5.2	0.1	1.0	—	—
Red Lake	27.2	0.6	2.3	0.1	20.1	0.1	3.8	0.2	—
Redwood	6.2	—	0.3	—	4.9	0.1	0.9	—	—
Renville	7.2	—	0.2	—	5.8	0.1	1.0	—	0.1
Rock	0.5	—	0.1	—	0.4	—	—	—	—
Sibley	10.9	—	0.1	—	8.8	0.1	1.9	—	—
Steele	5.0	—	0.1	—	3.9	0.1	0.9	—	—
Stevens	1.0	—	—	—	0.8	—	0.2	—	—
Swift	4.7	—	0.4	—	3.7	—	0.6	—	—
Traverse	0.9	—	—	—	0.8	—	0.1	—	—
Waseca	4.6	—	0.1	—	3.5	—	1.0	—	—
Watonwan	1.1	—	0.2	—	0.9	—	—	—	—
Wilkin	0.5	—	—	—	0.5	—	—	—	—
Yellow Medicine	7.8	—	0.2	—	6.3	0.1	1.1	—	0.1
All counties	534.2	9.0	45.0	3.0	396.0	4.5	73.7	1.7	1.3

Table 4.—*Area of commercial forest land by county and forest type, Prairie Unit, Minnesota, 1977*
(In thousand acres)

County	All types	Forest type						
		Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Balsam poplar	Non-stocked
Big Stone	2.4	—	0.2	0.6	0.7	0.8	0.1	—
Blue Earth	21.4	—	5.0	2.2	11.7	2.0	0.2	0.3
Brown	9.1	—	2.5	1.0	4.6	0.8	0.1	0.1
Chippewa	3.9	—	0.2	1.0	1.0	1.4	0.2	0.1
Clay	10.3	—	2.0	1.6	2.0	4.0	0.6	0.1
Cottonwood	2.5	—	0.2	0.5	1.1	0.6	0.1	—
Dodge	6.4	—	2.5	0.3	3.3	0.2	—	0.1
Faribault	6.2	—	0.8	1.1	3.4	0.8	0.1	—
Freeborn	4.8	—	1.6	0.3	2.2	0.5	0.1	0.1
Grant	2.9	—	0.9	0.3	0.8	0.9	—	—
Jackson	2.1	—	0.5	0.2	1.0	0.4	—	—
Kandiyohi	9.9	—	3.5	1.3	2.7	2.0	0.3	0.1
Kittson	67.5	—	3.7	3.9	1.9	52.3	5.0	0.7
Lac qui Parle	4.6	—	0.5	1.1	1.9	1.0	0.1	—
Lincoln	2.0	—	0.5	0.2	0.9	0.4	—	—
Lyon	4.4	—	0.6	0.9	2.0	0.7	0.1	0.1
McLeod	5.8	—	1.2	0.5	3.5	0.6	—	—
Marshall	128.5	0.7	8.3	11.4	5.7	87.9	13.2	1.3
Martin	3.6	—	0.4	0.6	1.5	0.9	0.1	0.1
Meeker	10.8	—	2.7	0.7	6.6	0.4	0.1	0.3
Mower	5.2	—	1.7	0.3	2.8	0.3	—	0.1
Murray	1.1	—	0.1	0.3	0.5	0.2	—	—
Nicollet	12.3	—	2.3	1.1	7.4	1.1	0.1	0.3
Nobles	0.7	—	0.1	0.1	0.2	0.3	—	—
Norman	22.2	—	1.8	3.2	4.0	11.5	1.4	0.3
Pennington	30.7	—	2.5	2.8	3.5	19.3	2.4	0.2
Pipestone	0.4	—	0.1	0.1	0.1	0.1	—	—
Polk	68.0	0.1	8.9	7.7	13.2	32.4	5.1	0.6
Pope	6.9	0.1	1.1	1.2	1.3	2.7	0.4	0.1
Red Lake	27.2	—	2.4	2.0	2.8	17.7	2.1	0.2
Redwood	6.2	—	1.3	1.0	2.1	1.5	0.2	0.1
Renville	7.2	0.1	1.6	0.9	3.3	1.1	0.1	0.1
Rock	0.5	—	—	0.1	0.2	0.2	—	—
Sibley	10.9	—	2.8	1.0	6.0	0.9	0.1	0.1
Steele	5.0	—	1.4	0.3	2.6	0.5	0.1	0.1
Stevens	1.0	—	0.2	0.1	0.2	0.5	—	—
Swift	4.7	—	0.5	1.0	1.7	1.3	0.1	0.1
Traverse	0.9	—	0.1	0.2	0.1	0.4	0.1	—
Waseca	4.6	—	0.9	0.4	2.7	0.5	—	0.1
Watonwan	1.1	—	—	0.4	0.7	—	—	—
Wilkin	0.5	—	—	0.1	—	0.4	—	—
Yellow Medicine	7.	1.7	1.1	3.3	1.5	0.1	0.1	
All counties	534.2	1.0	69.3	55.1	117.2	253.0	32.7	5.9

Table 5.—*Area of commercial forest land by county and site index class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

County	All classes	Site index class (feet)							
		91+	81-90	71-80	61-70	51-60	41-50	31-40	21-30
Big Stone	2.4	—	—	0.1	0.3	1.0	0.7	0.3	—
Blue Earth	21.4	0.3	0.2	2.1	4.0	7.5	4.2	3.1	—
Brown	9.1	0.1	0.1	0.6	2.1	3.4	1.7	1.1	—
Chippewa	3.9	—	—	0.2	0.4	1.7	1.0	0.6	—
Clay	10.3	—	—	1.1	1.2	2.8	2.6	2.6	—
Cottonwood	2.5	—	—	0.3	0.5	1.0	0.5	0.2	—
Dodge	6.4	0.2	0.1	0.3	1.3	2.5	1.1	0.9	—
Faribault	6.2	—	—	1.0	1.0	2.1	1.4	0.7	—
Freeborn	4.8	0.1	0.1	0.2	1.0	1.9	0.9	0.6	—
Grant	2.9	—	—	0.5	0.2	0.5	0.7	1.0	—
Jackson	2.1	—	—	0.3	0.4	0.7	0.4	0.3	—
Kandiyohi	9.9	0.1	—	0.4	1.1	4.2	2.7	1.4	—
Kittson	67.5	—	—	3.7	12.3	23.4	21.1	6.5	0.5
Lac qui Parle	4.6	—	—	0.5	0.8	1.7	1.1	0.5	—
Lincoln	2.0	—	—	0.2	0.4	0.8	0.4	0.2	—
Lyon	4.4	—	—	0.3	0.7	1.8	1.0	0.6	—
McLeod	5.8	—	—	1.2	0.7	1.6	1.2	1.1	—
Marshall	128.5	—	—	7.3	23.0	44.3	38.5	14.0	1.4
Martin	3.6	—	—	0.5	0.7	1.3	0.7	0.4	—
Meeker	10.8	0.1	0.3	0.8	2.6	3.6	2.2	1.2	—
Mower	5.2	0.1	0.1	0.3	1.2	2.0	0.9	0.6	—
Murray	1.1	—	—	—	0.1	0.6	0.3	0.1	—
Nicollet	12.3	—	0.3	1.3	3.0	4.1	2.4	1.2	—
Nobles	0.7	—	—	0.1	0.1	0.3	0.1	0.1	—
Norman	22.2	—	—	2.2	4.3	8.1	5.1	2.5	—
Pennington	30.7	—	—	2.8	6.7	10.9	7.7	2.5	0.1
Pipestone	0.4	—	—	—	0.1	0.1	0.1	0.1	—
Polk	68.0	0.1	—	6.9	12.8	22.7	16.5	8.9	0.1
Pope	6.9	—	—	0.5	1.1	2.4	1.7	1.1	0.1
Red Lake	27.2	—	—	2.4	5.8	9.9	6.8	2.3	—
Redwood	6.2	0.1	—	0.4	0.9	2.6	1.4	0.8	—
Renville	7.2	0.1	—	0.7	1.5	2.5	1.4	0.9	0.1
Rock	0.5	—	—	—	—	0.3	0.1	0.1	—
Sibley	10.9	0.1	0.1	1.2	2.0	3.7	2.1	1.7	—
Steele	5.0	0.1	0.1	0.3	1.1	1.8	1.0	0.6	—
Stevens	1.0	—	—	0.1	0.1	0.3	0.2	0.3	—
Swift	4.7	—	—	0.4	0.6	1.9	1.1	0.7	—
Traverse	0.9	—	—	—	0.1	0.4	0.2	0.2	—
Waseca	4.6	—	0.1	0.3	1.2	1.7	0.9	0.4	—
Watonwan	1.1	—	—	0.1	0.2	0.4	0.4	—	—
Wilkin	0.5	—	—	—	—	0.2	0.2	0.1	—
Yellow Medicine	7.8	—	—	0.9	1.4	2.8	1.7	1.0	—
All counties	534.2	1.5	1.5	42.5	99.0	187.5	136.4	63.5	2.3

Table 6.—*Area of commercial forest land by county and stand-size class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

County	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Big Stone	2.4	1.0	0.7	0.7	—
Blue Earth	21.4	15.3	3.3	2.5	0.3
Brown	9.1	6.5	1.5	1.0	0.1
Chippewa	3.9	1.3	1.3	1.2	0.1
Clay	10.3	3.7	3.2	3.3	0.1
Cottonwood	2.5	1.2	0.9	0.4	—
Dodge	6.4	5.0	0.9	0.4	0.1
Faribault	6.2	4.0	1.3	0.9	—
Freeborn	4.8	3.3	0.8	0.6	0.1
Grant	2.9	1.4	1.1	0.4	—
Jackson	2.1	1.4	0.5	0.2	—
Kandiyohi	9.9	6.0	2.1	1.7	0.1
Kittson	67.5	6.3	28.0	32.5	0.7
Lac qui Parle	4.6	2.3	1.2	1.1	—
Lincoln	2.0	1.4	0.5	0.1	—
Lyon	4.4	2.3	1.9	0.9	0.1
McLeod	5.8	4.3	1.0	0.5	—
Marshall	128.5	16.7	47.7	62.9	1.2
Martin	3.6	2.0	1.1	0.4	0.1
Meeker	10.8	8.8	0.7	1.0	0.3
Mower	5.2	4.0	0.8	0.3	0.1
Murray	1.1	0.6	0.3	0.2	—
Nicollet	12.3	9.3	1.4	1.3	0.3
Nobles	0.7	0.3	0.3	0.1	—
Norman	22.2	6.4	9.6	5.9	0.3
Pennington	30.7	6.3	14.3	9.9	0.2
Pipestone	0.4	0.2	0.2	—	—
Polk	68.0	20.7	26.1	20.5	0.7
Pope	6.9	2.4	2.4	2.0	0.1
Red Lake	27.2	5.3	13.0	8.7	0.2
Redwood	6.2	3.1	1.8	1.2	0.1
Renville	7.2	4.5	1.5	1.1	0.1
Rock	0.5	0.2	0.2	0.1	—
Sibley	10.9	8.0	1.8	1.0	0.1
Steele	5.0	3.6	0.8	0.5	0.1
Stevens	1.0	0.4	0.4	0.2	—
Swift	4.7	2.0	1.6	1.0	0.1
Traverse	0.9	0.3	0.3	0.3	—
Waseca	4.6	3.5	0.5	0.5	0.1
Watonwan	1.1	0.6	0.2	0.3	—
Wilkin	0.5	0.1	0.1	0.3	—
Yellow Medicine	7.8	4.6	2.2	0.9	0.1
All counties	534.2	180.6	178.7	169.0	5.9

Table 7.—*Area of commercial forest land by site and ownership class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth / acre / year)		
		85-120	50-85	20-5
Miscellaneous federal	9.0	—	1.3	7.7
State	45.0	—	25.1	19.9
Forest industry	3.0	—	1.7	1.3
Farmer	396.0	16.5	122.5	257.0
Misc. private-corp.	4.5	—	—	4.5
Misc. private-individual	73.7	2.4	22.1	49.2
Misc. priv.-corp., leased	1.7	—	1.7	—
Misc. priv.-ind., leased	1.3	—	1.3	—
All owners	534.2	18.9	175.7	339.6

Table 8.—*Area of commercial forest land by forest type and ownership class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All types	Forest type						
		Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Balsam poplar	Non-stocked
Miscellaneous federal	9.0	—	—	—	—	4.0	3.4	1.6
State	45.0	1.0	—	4.9	—	32.4	6.7	—
Forest industry	3.0	—	1.3	—	—	—	1.7	—
Farmer	396.0	—	60.9	43.1	84.9	186.2	16.6	4.3
Misc. private-corp.	4.5	—	1.5	—	—	1.3	1.7	—
Misc. private-individual	73.7	—	5.6	7.1	31.0	27.4	2.6	—
Misc. private corp., leased	1.7	—	—	—	—	1.7	—	—
Misc. private ind., leased	1.3	—	—	—	1.3	—	—	—
All owners	534.2	1.0	69.3	55.1	117.2	253.0	32.7	5.9

Table 9.—*Area of commercial forest land by forest type and stand-age class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

Forest type	All ages	Stand-age class (years)											
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140
Tamarack	1.0	—	1.0	—	—	—	—	—	—	—	—	—	—
Oak-hickory	69.3	6.0	1.3	—	1.3	6.1	2.8	9.9	9.5	15.6	14.2	2.6	—
Elm-ash-cottonwood	55.1	1.3	—	6.2	6.1	9.7	10.8	7.9	2.6	1.6	5.9	1.3	1.7
Maple-basswood	117.2	1.3	6.2	5.3	1.5	5.4	17.1	25.2	29.8	11.9	9.7	9.7	1.1
Aspen	253.0	61.0	45.9	24.7	46.9	45.3	16.1	8.0	3.8	1.3	—	—	—
Balsam poplar	32.7	6.3	5.1	3.0	8.1	7.4	1.5	1.3	—	—	—	—	—
Nonstocked	5.9	1.4	1.5	—	1.3	1.7	—	—	—	—	—	—	—
All types	534.2	77.3	61.0	39.2	65.2	75.6	48.3	52.3	38.7	30.4	29.8	13.6	2.8

Table 10.—*Area of commercial forest land by forest type, stand-size class, and site class, Prairie Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class (cubic feet of growth / acre / year)		
		85-120	50-85	Less than 50
Tamarack				
Sawtimber	—	—	—	—
Poletimber	—	—	—	—
Sapling & seedling	1.0	—	—	1.0
All stands	1.0	—	—	1.0
Oak-hickory				
Sawtimber	44.0	—	7.6	36.4
Poletimber	18.0	—	—	18.0
Sapling & seedling	7.3	—	1.5	5.8
All stands	69.3	—	9.1	60.2
Elm-ash-cottonwood				
Sawtimber	34.3	1.5	9.7	23.1
Poletimber	17.8	—	—	17.8
Sapling & seedling	3.0	—	—	3.0
All stands	55.1	1.5	9.7	43.9
Maple-basswood				
Sawtimber	93.9	1.5	37.2	55.2
Poletimber	13.4	—	2.9	10.5
Sapling & seedling	9.9	1.1	2.0	6.8
All stands	117.2	2.6	42.1	72.5
Aspen				
Sawtimber	8.4	—	4.1	4.3
Poletimber	111.3	12.2	54.7	44.4
Sapling & seedling	133.3	2.6	47.7	83.0
Allstands	253.0	14.8	106.5	131.7
Balsam poplar				
Sawtimber	—	—	—	—
Poletimber	18.2	—	6.6	11.6
Sapling & seedling	14.5	—	1.7	12.8
All stands	32.7	—	8.3	24.4
Nonstocked	5.9	—	—	5.9
All types	534.2	18.9	175.7	339.6

Table 11.—*Area of noncommercial forest land by ownership class, Prairie Unit, Minnesota, 1977*
(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National forest	—	—	—
Other federal	4.4	3.3	1.1
State, county and municipal	13.1	5.4	7.7
Forest industry	—	—	—
Farmer	23.2	—	23.2
Miscellaneous private	6.6	—	6.6
All ownerships	47.3	8.7	38.6

Table 12.—*Area of noncommercial forest land by forest type, Prairie Unit, Minnesota, 1977*
(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Spruce-fir	2.6	2.6	—
Black spruce	2.7	—	2.7
Oak-hickory	16.6	2.6	14.0
Elm-ash-cottonwood	6.2	3.1	3.1
Maple-basswood	1.4	0.1	1.3
Aspen-birch	17.8	0.3	17.5
All types	47.3	8.7	38.6

Table 13.—*Number of all live trees on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
Red pine	19	—	—	—	—	—	7	4	3	5	—	—	—	—	—
Jack pine	43	—	—	—	17	19	7	—	—	—	—	—	—	—	—
White spruce	39	—	—	26	—	—	—	6	—	7	—	—	—	—	—
Black spruce	183	100	—	83	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	192	133	—	59	—	—	—	—	—	—	—	—	—	—	—
Tamarack	188	—	100	17	65	—	—	6	—	—	—	—	—	—	—
Other softwoods	3,222	1,643	1,198	277	47	52	—	5	—	—	—	—	—	—	—
Total	3,886	1,876	1,298	462	129	71	14	21	3	12	—	—	—	—	—
HARDWOODS:															
Select white oaks	18,318	5,659	4,310	2,318	1,459	1,581	1,266	679	502	219	160	81	73	11	—
Select red oaks	2,315	289	375	367	441	217	163	195	116	66	18	28	29	11	—
Other red oaks	45	—	—	30	—	—	—	5	6	—	1	2	1	—	—
Hickory	82	—	—	40	20	11	8	—	—	1	2	—	—	—	—
Yellow birch	36	—	—	—	36	—	—	—	—	—	—	—	—	—	—
Hard maple	2,699	1,083	355	427	305	141	136	138	52	42	10	5	5	—	—
Soft maple	341	—	—	125	63	30	22	42	11	3	14	4	12	10	5
Ash	14,724	6,906	3,089	1,680	1,281	776	420	295	109	70	27	31	36	4	—
Balsam poplar	22,454	9,988	5,977	3,075	2,021	872	374	123	18	4	—	—	—	1	1
Paper birch	1,472	521	402	261	150	95	32	4	3	4	—	—	—	—	—
Bigtooth aspen	79	65	—	14	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	111,553	58,571	21,528	15,781	9,888	4,096	1,207	375	88	12	3	4	—	—	—
Basswood	4,981	2,307	436	263	351	336	368	313	257	190	81	37	37	5	—
Elm	18,991	8,850	4,709	1,761	990	730	470	371	389	192	161	112	176	71	9
Select hardwoods	3,602	2,320	739	218	191	69	20	27	—	12	2	2	2	—	—
Other hardwoods	21,290	9,135	5,260	2,633	1,720	1,007	667	381	184	90	75	60	44	24	10
Noncommercial species	10,912	8,672	1,356	611	224	41	8	—	—	—	—	—	—	—	—
Total	233,894	114,366	48,536	29,604	19,140	10,002	5,161	2,948	1,735	905	554	366	415	137	25
All species	237,780	116,242	49,834	30,066	19,269	10,073	5,175	2,969	1,738	917	554	366	415	137	25

Table 14.—*Number of growing-stock trees on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height)													
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
Red pine	19	—	—	—	—	—	7	4	3	5	—	—	—	—	—
Jack pine	43	—	—	—	17	19	7	—	—	—	—	—	—	—	—
White spruce	39	—	—	26	—	—	—	6	—	7	—	—	—	—	—
Black spruce	184	100	—	84	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	192	133	—	59	—	—	—	—	—	—	—	—	—	—	—
Tamarack	178	—	100	17	55	—	—	6	—	—	—	—	—	—	—
Other softwoods	1,361	290	736	255	47	28	—	5	—	—	—	—	—	—	—
Total	2,016	523	836	441	119	47	14	21	3	12	—	—	—	—	—
HARDWOODS:															
Select white oaks	14,774	4,660	3,156	1,718	1,294	1,450	1,077	569	418	185	124	62	53	8	—
Select red oaks	2,074	289	375	317	382	185	156	165	105	39	13	17	24	7	—
Other red oaks	45	—	—	31	—	—	—	5	5	—	1	2	1	—	—
Hickory	80	—	—	40	19	11	8	—	—	—	2	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	2,413	1,083	356	331	266	114	78	95	43	36	6	2	3	—	—
Soft maple	276	—	—	125	63	29	14	12	11	—	7	4	7	2	2
Ash	11,056	5,047	2,241	1,385	1,084	590	288	213	86	59	19	26	17	1	—
Balsam poplar	17,955	8,337	4,444	2,419	1,637	736	266	96	15	4	—	—	—	1	—
Paper birch	1,371	521	402	173	150	95	19	4	3	4	—	—	—	—	—
Bigtooth aspen	14	—	—	14	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	84,415	45,854	17,119	10,838	6,991	2,707	687	174	39	6	—	—	—	—	—
Basswood	4,332	2,030	436	240	259	261	317	267	219	170	66	35	30	2	—
Elm	14,668	7,277	3,399	1,201	749	563	287	290	327	164	130	92	140	44	5
Select hardwoods	2,939	1,899	739	58	149	49	13	16	—	12	—	2	2	—	—
Other hardwoods	15,322	6,555	4,193	1,685	1,248	772	369	233	76	57	46	41	21	18	8
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	171,734	83,552	36,860	20,575	14,291	7,562	3,579	2,139	1,347	736	414	283	298	83	15
All species	173,750	84,075	37,696	21,016	14,410	7,609	3,593	2,160	1,350	748	414	283	298	83	15

Table 15.—*Number of short-log trees on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand trees)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	—	—	—	—	—	—	—	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—
Jack pine	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	24	24	—	—	—	—	—	—	—	—	—
Total	24	24	—	—	—	—	—	—	—	—	—
HARDWOODS:											
Select white oaks	234	—	64	71	54	11	17	8	8	1	—
Select red oaks	5	—	—	5	—	—	—	—	—	—	—
Hard maple	41	—	22	12	3	—	2	—	2	—	—
Soft maple	19	—	—	17	—	—	2	—	—	—	—
Ash	45	—	19	18	4	3	—	—	—	1	—
Balsam poplar	28	—	27	—	—	—	—	—	—	—	1
Quaking aspen	133	—	79	43	11	—	—	—	—	—	—
Basswood	33	—	12	10	7	4	—	—	—	—	—
Elm	166	—	100	11	26	6	5	6	9	3	—
Other hardwoods	187	—	88	65	20	7	3	—	2	—	2
Total	891	—	411	252	125	31	29	14	21	5	3
All species	915	24	411	252	125	31	29	14	21	5	3

Table 16.—*Net volume of growing stock and sawtimber on commercial forest land by species, Prairie Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	[1]1962	1977	[1]1962	1977
	Thousand cubic feet		*[2]Thousand board feet*	
SOFTWOODS:				
Red pine	640	492	3,011	3,167
Jack pine	315	292	603	1,100
Spruce	816	453	852	1,794
Balsam fir	592	174	612	—
Tamarack	812	313	755	447
Northern white cedar	1,486	—	2,223	—
Other softwoods	—	825	—	1,259
Total	4,661	2,549	8,056	7,767
HARDWOODS:				
White oak	54,903	60,049	160,981	226,880
Red oak	16,042	16,074	38,019	65,510
Hard maple	5,564	7,484	18,793	29,372
Soft maple	3,609	3,335	8,901	17,241
Ash	25,433	23,733	45,243	100,769
Paper birch	2,269	3,048	1,323	2,876
Aspen	65,304	97,226	51,669	68,477
Basswood	18,512	29,510	55,458	148,474
Elm	65,698	58,860	241,828	270,859
Other hardwoods	35,081	60,344	53,681	169,872
Total	292,055	359,663	675,896	1,100,330
All species	296,716	362,212	683,952	1,108,097

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures

[2]International ¼-inch rule.

Table 17.—*Cubic foot volume in all live trees on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)											
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
Red pine	492	—	—	—	87	95	100	210	—	—	—	—	—
Jack pine	291	—	67	148	76	—	—	—	—	—	—	—	—
White spruce	390	60	—	—	—	111	—	219	—	—	—	—	—
Black spruce	63	63	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	174	174	—	—	—	—	—	—	—	—	—	—	—
Tamarack	313	21	197	—	—	95	—	—	—	—	—	—	—
Other softwoods	939	415	127	314	—	83	—	—	—	—	—	—	—
Total	2,662	733	391	462	163	384	100	429	—	—	—	—	—
HARDWOODS:													
Select white oaks	67,806	3,512	5,292	9,969	12,026	9,218	9,322	5,515	4,881	3,232	4,123	716	—
Select red oaks	17,561	792	1,868	1,497	2,026	3,133	2,428	1,583	650	1,147	1,589	848	—
Other red oaks	522	65	—	—	—	85	140	—	49	148	35	—	—
Hickory	412	27	73	87	90	—	—	37	98	—	—	—	—
Yellow birch	100	—	100	—	—	—	—	—	—	—	—	—	—
Hard maple	8,794	837	1,248	903	1,070	1,868	1,001	1,041	288	245	293	—	—
Soft maple	5,057	311	349	323	208	394	321	70	387	150	738	783	1,023
Ash	27,654	2,961	5,088	4,506	3,498	4,068	2,031	1,604	761	1,310	1,627	200	—
Balsam poplar	29,332	6,418	9,175	6,765	4,117	2,141	411	96	—	—	—	172	37
Paper birch	3,287	701	1,013	897	420	87	70	99	—	—	—	—	—
Bigtooth aspen	27	27	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	123,202	32,370	40,905	29,818	12,751	5,363	1,600	275	33	87	—	—	—
Basswood	32,404	575	1,356	2,379	4,279	5,139	5,383	5,617	3,050	1,925	2,326	375	—
Elm	66,860	3,136	3,669	4,632	4,384	5,425	7,938	5,446	5,760	5,206	11,347	8,011	1,906
Select hardwoods	2,424	229	653	399	186	398	—	317	34	79	129	—	—
Other hardwoods	38,270	3,554	4,944	5,443	4,312	4,159	2,280	1,842	2,154	2,310	1,959	2,572	2,741
Noncommercial species	1,929	848	797	209	75	—	—	—	—	—	—	—	—
Total	425,641	56,363	76,530	67,827	49,442	41,478	32,925	23,542	18,145	15,839	24,166	13,677	5,707
All species	428,303	57,096	76,921	68,289	49,605	41,862	33,025	23,971	18,145	15,839	24,166	13,677	5,707

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwooods and hardwoods, Prairie Unit, Minnesota, 1977*

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
GROWING STOCK TREES:			
Saw log trees:			
Saw log portion	140,548	1,039	139,509
Upper-stem portion	49,978	399	49,579
Subtotal	190,526	1,438	189,088
Poletimber trees	171,686	1,111	170,575
Total	362,212	2,549	359,663
CULL TREES:			
Rough and rotten cull trees:			
Sawtimber	24,666	—	24,666
Poletimber	30,158	12	30,146
Subtotal	54,824	12	54,812
Short-log cull trees:			
Sawtimber	11,267	101	11,166
Poletimber	—	—	—
Subtotal	11,267	101	11,166
Total	66,091	113	65,978
SALVABLE DEAD TREES:	520	—	520
All classes	428,823	2,662	426,161

Table 19.—*Net volume of growing stock on commercial forest land by species and county, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All Counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cotton-wood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyoh	Kittson	Lac Qui Parle	Lincoln	Lyon	McLeod	Marshall	Martin
SOFTWOODS																				
Red pine	492	—	—	—	—	—	—	—	—	—	—	—	—	186	—	—	—	—	233	—
Jack pine	292	—	—	—	—	—	—	—	—	—	—	—	—	110	—	—	—	—	138	—
White spruce	390	—	2	—	—	12	—	—	—	2	—	—	3	46	1	—	—	—	155	—
Black spruce	63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	46	—
Balsam fir	174	—	—	—	—	—	—	—	—	—	—	—	—	68	—	—	—	—	82	—
Tamarack	313	—	—	—	—	—	—	—	—	—	—	—	—	93	—	—	—	—	166	—
Other softwoods	825	2	93	66	5	8	—	69	6	43	1	3	57	13	2	9	10	1	41	1
Total	2,549	2	95	66	5	20	—	69	6	45	1	3	60	516	3	9	10	1	861	1
HARDWOODS·																				
Select white oak	60,049	273	3,878	1,554	364	1,738	280	1,325	946	946	744	412	2,493	3,745	455	402	533	1,369	8,424	502
Select red oak	15,552	9	1,662	914	17	104	12	878	143	578	45	105	460	707	21	123	161	166	1,112	64
Other red oaks	522	—	56	30	—	39	—	28	2	19	17	7	11	—	—	4	3	4	7	2
Hickory	376	—	58	26	—	—	—	27	10	17	—	3	18	—	—	3	4	18	2	3
Hard maple	7,484	—	1,117	293	—	295	—	243	197	173	126	113	34	—	—	36	51	465	112	86
Soft maple	3,335	11	369	202	14	12	32	163	101	100	3	22	130	37	56	31	54	86	89	38
Ash	23,733	119	1,274	578	188	696	215	322	506	217	320	131	375	1,366	384	125	296	411	3,296	246
Balsam poplar	25,779	89	201	94	172	313	112	—	104	28	54	57	224	4,780	140	63	96	48	8,309	158
Paper birch	3,048	22	118	53	40	149	18	36	35	32	57	12	72	185	32	15	26	40	550	28
Bigtooth aspen	27	—	1	—	—	8	—	—	—	—	3	1	—	—	—	—	—	1	2	—
Quaking aspen	97,199	282	982	469	487	1,427	382	162	446	221	458	206	709	16,958	480	230	359	309	29,096	521
Basswood	29,510	124	3,253	1,304	174	307	191	1,055	759	712	120	263	887	528	337	226	453	927	1,432	321
Elm	58,860	323	4,810	1,955	497	1,275	566	1,256	1,624	830	579	435	1,464	1,693	1,006	400	866	1,655	4,505	751
Select hardwoods	1,955	6	225	102	8	8	16	71	56	46	2	18	39	27	29	15	29	58	63	25
Other hardwoods	32,234	314	1,668	886	472	905	329	501	673	375	186	170	971	1,479	637	185	544	281	5,258	339
Total	359,663	1,572	19,672	8,460	2,433	7,276	2,153	6,067	5,602	4,294	2,714	1,955	7,887	31,505	3,577	1,858	3,475	5,838	62,257	3,084
All species	362,212	1,574	19,767	8,526	2,438	7,296	2,153	6,136	5,608	4,339	2,715	1,958	7,947	32,021	3,580	1,867	3,485	5,839	63,118	3,085

(Table 19 continued on next page)

(Table 19 continued)

Species	Meeker	Mower	Murray	Nicollet	Nobles	Norman	Pennington	Pipe-stone	Polk	Pope	Red Lake	Redwood	Renville	Rock	Sibley	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
SOFTWOODS																							
Red pine	—	—	—	—	—	7	23	—	24	1	18	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	—	—	—	—	—	4	14	—	14	1	11	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	—	1	—	17	33	—	87	1	23	3	2	—	—	2	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—		—	—	4	9	—	—	4	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	2	8	—	8		6	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	4	12	—	16	9	9	—	4	—	—	—	—	—	—	—	—	—	—
Other softwoods	31	46	—	20	—	7	8	3	53	22	25	31	33	1	51	24	—	7	2	10	—	1	20
Total	31	46	—	21	—	41	98	3	206	43	92	34	43	1	51	26	—	7	2	10	—	1	20
HARDWOODS																							
Select white oak	2 031	993	156	2 060	84	2 167	2 624	67	8 219	878	2 298	929	1 199	44	2 119	892	156	554	79	656	72	41	1 348
Select red oak	1 120	670	29	966	2	176	424	24	1 020	195	593	294	450	4	882	523	2	71	1	480	9	—	336
Other red oaks	50	23	1	47	—	—	1	1	36	11	6	7	21	—	28	23	—	1	—	22	—	—	15
Hickory	23	18	—	20	—	—	3	1	26	6	9	10	13	—	31	11	—	2	—	6	—	—	8
Hard maple	843	227	15	816	—	—	58	2	543	67	48	34	195	—	560	270	—	3	—	315	—	—	147
Soft maple	118	113	2	150	4	103	96	8	368	50	104	84	132	1	192	63	3	37	3	34	21	—	99
Ash	525	275	57	770	41	1 135	1 291	28	3 863	361	1 018	320	562	25	697	290	76	311	36	243	112	13	619
Balsam poplar	31	29	24	146	43	1 431	2 149	19	3 575	307	1 969	196	138	18	89	51	39	165	41	48	2	15	212
Paper birch	40	30	5	49	8	167	140	4	550	54	94	50	47	5	73	34	17	46	11	23	—	7	74
Bigtooth aspen	1	—	—	2	—	—	—	—	4	0	—	—	2	—	—	1	—	—	—	—	—	—	1
Quaking aspen	207	204	72	599	135	5 353	8 665	69	14 340	1 120	8 048	668	582	49	562	282	184	639	107	166	19	65	880
Basswood	1 960	850	122	1 986	30	715	785	36	2 780	306	749	520	814	31	1 672	755	32	316	21	768	131	8	750
Elm	2 267	1 034	180	2 805	106	2 468	2 381	77	8 459	717	1 807	962	1 553	69	2 545	959	162	793	94	899	314	28	1 691
Select hardwoods	136	59	3	149	2	54	54	2	187	18	48	29	64	1	115	50	2	16	2	56	11	—	54
Other hardwoods	615	388	124	904	68	1 638	1 458	41	4 564	629	1 049	646	771	71	766	330	68	533	112	281	206	47	752
Total	9 967	4 913	790	11 469	523	15 407	20 129	379	48 534	4 719	17 840	4 749	6 543	318	10 331	4 534	741	3 487	507	3 997	897	224	6 986
All species	9 998	4 959	790	11 490	524	15 448	20 227	382	48 740	4 762	17 932	4 783	6 586	319	10 382	4 560	741	3 494	509	4 007	897	225	7 006

Table 20.—*Net volume of sawtimber on commercial forest land by species and county, Prairie Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All Counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cotton-wood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyoh	Kittson	Lac Qui Parle	Lincoln	Lyon	McLeod	Marshall	Martin
SOFTWOODS																				
Red pine	3,167	—	—	—	—	—	—	—	—	—	—	—	—	1,198	—	—	—	—	1,500	—
Jack pine	1,100	—	—	—	—	—	—	—	—	—	—	—	—	416	—	—	—	—	521	—
White spruce	1,794	—	8	—	—	68	—	—	—	8	—	—	17	137	9	—	—	—	687	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	447	—	—	—	—	—	—	—	—	—	—	—	—	169	—	—	—	—	212	—
Other softwoods	1,259	5	135	96	10	16	—	100	9	64	2	4	85	25	3	13	15	1	81	1
Total	7,767	5	143	96	10	84	—	100	9	72	2	4	102	1,945	12	13	15	1	3,001	1
HARDWOODS																				
Select white oak	226,880	1,041	16,833	6,870	1,221	6,452	1,043	6,046	3,998	4,249	2,940	1,696	11,727	9,620	1,822	1,759	2,243	5,794	24,699	1,891
Select red oak	63,107	47	7,507	3,901	87	588	62	3,667	693	2,439	251	517	1,750	1,380	110	523	722	896	2,481	332
Other red oaks	2,403	1	246	125	—	214	—	110	8	76	92	37	34	—	—	16	21	25	41	10
Hickory	851	—	151	41	—	—	—	43	36	27	—	9	31	—	—	5	6	78	10	10
Hard maple	29,372	—	4,462	1,392	—	558	—	1,137	654	815	239	404	114	—	—	171	247	1,471	285	330
Soft maple	17,241	74	1,749	873	111	87	191	659	530	403	28	130	585	303	297	158	265	504	636	252
Ash	100,769	605	6,991	2,915	974	2,820	1,163	1,587	2,884	1,026	1,426	669	1,844	2,635	2,059	656	1,591	2,517	8,565	1,347
Balsam poplar	29,054	149	354	181	314	368	237	—	206	16	78	119	381	4,148	262	134	174	93	7,529	330
Paper birch	2,876	34	45	9	43	191	—	—	6	31	37	3	57	284	15	—	25	6	1,011	6
Quaking aspen	68,477	225	844	465	415	835	363	136	430	134	249	180	592	10,077	468	203	325	210	18,437	468
Basswood	148,474	585	17,264	6,895	791	1,077	925	5,668	4,015	3,787	455	1,328	4,626	2,203	1,720	1,150	2,364	4,930	5,973	1,564
Elm	270,859	1,437	23,224	9,325	2,113	6,192	2,536	6,035	7,855	3,974	2,945	2,001	7,092	6,208	4,713	1,842	3,991	8,285	18,529	3,383
Select hardwoods	5,339	3	756	326	—	—	15	251	104	175	—	59	45	—	32	40	69	141	19	55
Other hardwoods	134,628	1,111	7,913	4,511	1,496	3,635	1,328	2,759	2,872	1,967	794	746	4,150	5,244	2,537	841	2,079	1,353	20,066	1,415
Total	1,100,330	5,312	88,339	37,829	7,565	23,017	7,863	28,098	24,291	19,119	9,534	7,898	33,028	42,102	14,035	7,498	14,122	26,303	108,281	11,393
All species	1,108,097	5,317	88,482	37,925	7,575	23,101	7,863	28,198	24,300	19,191	9,536	7,902	33,130	44,047	14,047	7,511	14,137	26,304	111,282	11,394

[1]International ¼-inch rule.

(Table 20 continued on next page)

Table 20 Continued

Species	Meeker	Mower	Murray	Nicollet	Nobles	Norman	Pennington	Pipe-stone	Polk	Pope	Red Lake	Redwood	Renville	Rock	Sibley	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
SOFTWOODS																							
Red pine	—	—	—	—	—	45	148	—	154	6	116	—	—	—	—		—		—	—	—	—	—
Jack pine	—	—	—	—	—	16	51	—	54	2	40	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	—	8	—	86	165	—	452	6	110	17	8	—	—	8	—	—	—	—	—	—	
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	6	21	—	22	1	16	—	—	—	—	—	—	—	—	—	—	—	
Other softwoods	44	66	1	28	1	13	14	4	85	35	39	45	48	1	73	35	1	10	3	15	—	1	30
Total	44	66	1	36	1	166	399	4	767	50	321	62	56	1	73	43	1	10	3	15	—	1	30
HARDWOODS																							
Select white oak	9 258	4 460	722	9 010	279	7 033	8 371	253	31 043	2 990	7 237	3 849	4 955	157	9 289	3 936	600	2 085	243	2 954	354	117	5 741
Select red oak	5 432	2 880	154	4 765	10	532	1 223	93	3 753	746	1 884	1 163	1 931	19	3 949	2 402	7	301	5	2 363	50	—	1 492
Other red oaks	240	95	5	232	—	—	2	2	178	51	20	24	93	—	119	110	—	2	—	106	—	—	68
Hickory	51	29	—	48	—	—	12	2	77	10	17	18	24	—	80	15	—	3	—	6	—	—	12
Hard maple	3 778	1 085	75	3 528	-	—	185	6	1 532	141	185	139	729	—	2 268	1 239	—	12	—	1 566	—	—	625
Soft maple	547	471	18	756	35	742	615	40	2 093	257	587	409	614	10	907	275	26	218	22	157	95	2	510
Ash	2 822	1 382	342	4 092	221	4 859	4 335	142	16 786	1 387	2 950	1 639	2 760	136	3 849	1 439	383	1 651	161	1 273	622	37	3 227
Balsam poplar	37	62	47	274	88	2 087	2 431	41	4 404	444	2 191	356	264	32	165	83	67	302	69	88	—	11	438
Paper birch	23	—	3	17	3	151	125	—	412	57	77	34	9	6	21	14	19	49	15	9	—	20	9
Quaking aspen	173	175	61	575	115	4 235	6 607	59	10 790	905	6 257	547	543	42	437	202	120	493	91	156	52	32	754
Basswood	10 411	4 524	651	10 426	115	2 960	3 567	175	13 240	1 414	3 493	2 637	4 201	155	8 883	3 962	124	1 542	76	4 055	724	18	3 801
Elm	10 966	4 906	798	13 394	439	10 459	10 128	336	39 746	3 087	7 319	4 327	7 347	293	12 419	4 557	783	3 562	408	4 246	1 503	123	8 033
Select hardwoods	677	231	14	638	—	27	47	2	239	14	52	43	159	—	388	240	—	13	—	308	15	—	142
Other hardwoods	2 979	2 051	306	4 302	247	6 401	5 756	183	19 082	2 474	4 214	2 615	3 686	203	3 770	1 557	259	1 899	384	1 167	825	176	3 275
Total	47 394	22 351	3 196	52 057	1 552	39 486	43 404	1 334	143 375	13 977	36 483	17 800	27 315	1 053	46 544	20 031	2 388	12 132	1 474	18 454	4 240	536	28 127
All species	47 438	22 417	3 197	52 093	1 553	39 652	43 803	1 338	144 142	14 027	36 804	17 862	27 371	1 054	46 617	20 074	2 389	12 142	1 477	18 469	4 240	537	28 157

Table 21.— *Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Prairie Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				*Thousand board feet*[1]
SOFTWOODS:					
Red pine	492	492	—	—	3,167
Jack pine	292	292	—	—	1,100
White spruce	390	390	—	—	1,794
Black spruce	63	63	—	—	—
Balsam fir	174	174	—	—	—
Tamarack	313	313	—	—	447
Eastern redcedar	938	825	101	12	1,259
Total	2,662	2,549	101	12	7,767
HARDWOODS:					
White oak	1,706	1,432	241	33	7,392
Bur oak	66,100	58,617	3,094	4,389	219,488
Swamp white oak	—	—	—	—	—
Northern red oak	17,561	15,552	75	1,934	63,107
Black oak	—	—	—	—	—
Northern pin oak	522	522	—	—	2,403
Bitternut hickory	376	376	—	—	851
Shagbark hickory	36	—	—	36	—
Yellow birch	100	—	—	100	—
Sugar maple	8,794	7,484	610	700	29,372
Black maple	—	—	—	—	—
Red maple	206	206	—	—	412
Silver maple	4,851	3,129	198	1,524	16,829
White ash	385	356	—	29	2,730
Black ash	4,848	4,445	—	403	7,357
Green ash	22,421	18,932	755	2,734	90,682
Balsam poplar	29,332	25,779	383	3,170	29,054
Paper birch	3,287	3,048	—	239	2,876
Bigtooth aspen	27	27	—	—	—
Quaking aspen	123,202	97,199	1,939	24,064	68,477
Basswood	32,404	29,510	551	2,343	148,474
American elm	57,596	50,465	1,808	5,323	228,277
Slippery elm	8,508	7,839	47	622	39,641
Rock elm	756	556	—	200	2,941
Butternut	129	129	—	—	470
Black walnut	1,165	1,001	—	164	2,889
Black cherry	1,130	825	—	305	1,980
Boxelder	13,971	9,591	692	3,688	24,391
River birch	—	—	—	—	—
Hackberry	1,689	1,451	—	238	6,986
Eastern cottonwood	11,885	11,086	613	186	61,556
Black willow	10,152	9,676	84	392	40,464
Kentucky coffeetree	573	430	76	67	1,231
Noncommercial	1,929	—	—	1,929	—
Total	425,641	359,663	11,166	54,812	1,100,330
All species	428,303	362,212	11,267	54,824	1,108,097

[1]International ¼-inch rule.

Table 22.—*Net volume of growing stock on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)											
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
Red pine	492	—	—	—	87	95	100	210	—	—	—	—	—
Jack pine	292	—	68	148	76	—	—	—	—	—	—	—	—
White spruce	390	59	—	—	—	111	—	220	—	—	—	—	—
Black spruce	63	63	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	174	174	—	—	—	—	—	—	—	—	—	—	—
Tamarack	313	21	197	—	—	95	—	—	—	—	—	—	—
Other softwoods	825	403	126	213	—	83	—	—	—	—	—	—	—
Total	2,549	720	391	361	163	384	100	430	—	—	—	—	—
HARDWOODS:													
Select white oaks	60,049	3,181	5,010	9,586	10,801	8,183	8,278	4,879	4,012	2,569	3,000	550	—
Select red oaks	15,552	777	1,720	1,401	1,965	2,799	2,262	1,190	452	821	1,457	708	—
Other red oaks	522	65	—	—	—	84	140	—	50	148	35	—	—
Hickory	376	28	73	87	90	—	—	—	98	—	—	—	—
Hard maple	7,484	744	1,202	821	891	1,450	917	981	200	99	179	—	—
Soft maple	3,335	311	349	323	202	238	321	—	283	150	453	243	462
Ash	23,733	2,743	4,618	3,788	2,679	3,482	1,844	1,412	688	1,196	1,159	124	—
Balsam poplar	25,779	5,654	8,183	6,082	3,372	1,857	363	96	—	—	—	172	—
Paper birch	3,048	625	1,013	897	256	87	71	99	—	—	—	—	—
Bigtooth aspen	27	27	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	97,199	26,300	33,752	23,686	8,970	3,320	980	191	—	—	—	—	—
Basswood	29,510	534	1,074	2,008	3,846	4,660	5,024	5,354	2,707	1,923	2,132	247	—
Elm	58,860	2,710	3,446	4,306	3,562	5,006	7,546	5,121	5,223	4,837	10,200	5,704	1,200
Select hardwoods	1,955	80	602	328	147	273	—	317	—	79	129	—	—
Other hardwoods	32,234	3,089	4,379	4,973	3,740	3,361	1,588	1,518	1,808	1,910	1,466	2,290	2,112
Total	359,663	46,868	65,421	58,286	40,521	34,800	29,334	21,158	15,521	13,732	20,210	10,038	3,774
All species	362,212	47,588	65,812	58,647	40,684	35,184	29,434	21,588	15,521	13,732	20,210	10,038	3,774

Table 23.—*Net volume of sawtimber on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
Red pine	3,167	—	634	634	633	1,266	—	—	—	—	—
Jack pine	1,100	739	361	—	—	—	—	—	—	—	—
White spruce	1,794	—	—	660	—	1,134	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—
Tamarack	447	—	—	447	—	—	—	—	—	—	—
Other softwoods	1,259	986	—	273	—	—	—	—	—	—	—
Total	7,767	1,725	995	2,014	633	2,400	—	—	—	—	—
HARDWOODS:											
Select white oaks	226,880	—	58,228	44,256	44,411	25,523	21,236	14,356	16,041	2,829	—
Select red oaks	63,107	—	10,464	15,184	12,597	6,407	2,449	4,583	7,723	3,700	—
Other red oaks	2,403	—	—	464	791	—	252	717	179	—	—
Hickory	851	—	429	—	—	—	422	—	—	—	—
Hard maple	29,372	—	5,604	9,150	5,779	5,897	1,272	602	1,068	—	—
Soft maple	17,241	—	2,650	2,826	2,666	—	2,370	1,003	2,527	1,138	2,061
Ash	100,769	—	27,411	27,957	12,382	10,658	5,103	8,687	7,901	670	—
Balsam poplar	29,054	—	17,021	9,169	1,683	444	—	—	—	737	—
Paper birch	2,876	—	1,454	448	434	540	—	—	—	—	—
Quaking aspen	68,477	—	46,039	16,515	4,992	931	—	—	—	—	—
Basswood	148,474	—	22,124	26,540	29,316	30,663	15,487	10,703	12,310	1,331	—
Elm	270,859	—	19,659	28,021	43,007	28,894	29,685	26,954	56,720	31,070	6,849
Select hardwoods	5,339	—	626	1,327	—	2,374	—	542	470	—	—
Other hardwoods	134,628	—	30,836	25,262	11,425	10,895	12,218	11,879	9,155	12,523	10,435
Total	1,100,330	—	242,545	207,119	169,483	123,226	90,494	80,026	114,094	53,998	19,345
All species	1,108,097	1,725	243,540	209,133	170,116	125,626	90,494	80,026	114,094	53,998	19,345

[1]International ¼-inch rule.

Table 24.—*Net volume of growing stock on commercial forest land by species and forest type, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All types	Forest type						
		Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Balsam poplar	Non-stocked
SOFTWOODS:								
Red pine	492	—	—	—	—	492	—	—
Jack pine	292	—	—	—	—	292	—	—
White spruce	390	—	—	—	—	390	—	—
Black spruce	63	63	—	—	—	—	—	—
Balsam fir	174	—	—	—	—	174	—	—
Tamarack	313	67	—	95	—	151	—	—
Other softwoods	825	—	685	—	140	—	—	—
Total	2,549	130	685	95	140	1,499	—	—
HARDWOODS:								
Select white oaks	60,049	—	33,922	844	14,094	11,061	48	80
Select red oaks	15,552	—	8,522	—	6,687	343	—	—
Other red oaks	522	—	298	—	224	—	—	—
Hickory	376	—	250	—	126	—	—	—
Hard maple	7,484	—	89	—	7,395	—	—	—
Soft maple	3,335	—	—	2,576	759	—	—	—
Ash	23,733	—	1,568	4,211	13,383	3,578	768	225
Balsam poplar	25,779	—	263	1,842	613	13,479	9,582	—
Paper birch	3,048	—	—	663	407	1,883	95	—
Bigtooth aspen	27	—	—	—	27	—	—	—
Quaking aspen	97,199	—	4,122	1,032	2,621	87,594	1,584	246
Basswood	29,510	—	2,820	654	25,629	407	—	—
Elm	58,860	—	2,911	7,661	45,906	1,370	1,012	—
Select hardwoods	1,955	—	954	299	702	—	—	—
Other hardwoods	32,234	—	843	24,635	5,279	1,264	213	—
Total	359,663	—	56,562	44,417	123,852	120,979	13,302	551
All species	362,212	130	57,247	44,512	123,992	122,478	13,302	551

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Prairie Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All types	Forest type					
		Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Balsam poplar	Non-stocked
SOFTWOODS:							
Red pine	3,167	—	—	—	3,167	—	—
Jack pine	1,100	—	—	—	1,100	—	—
White spruce	1,794	—	—	—	1,794	—	—
Tamarack	447	—	447	—	—	—	—
Other softwoods	1,259	985	—	274	—	—	—
Total	7,767	985	447	274	6,061	—	—
HARDWOODS:							
Select white oaks	226,880	129,237	4,659	63,827	28,740	—	417
Select red oaks	63,107	32,081	—	31,026	—	—	—
Other red oaks	2,403	1,182	—	1,221	—	—	—
Hickory	851	429	—	422	—	—	—
Hard maple	29,372	550	—	28,822	—	—	—
Soft maple	17,241	—	13,814	3,427	—	—	—
Ash	100,769	5,622	12,253	79,218	1,954	—	1,722
Balsam poplar	29,054	295	4,756	1,698	14,823	7,482	—
Paper birch	2,876	—	2,876	—	—	—	—
Quaking aspen	68,477	5,921	—	3,272	57,488	1,796	—
Basswood	148,474	15,107	2,011	130,671	685	—	—
Elm	270,859	13,587	30,909	220,341	3,249	2,773	—
Select hardwoods	5,339	2,184	226	2,929	—	—	—
Other hardwoods	134,628	2,624	107,164	21,369	3,471	—	—
Total	1,100,330	208,819	178,668	588,243	110,410	12,051	2,139
All species	1,108,097	209,804	179,115	588,517	116,471	12,051	2,139

[1]International ¼-inch rule.

Table 26.—*Net volume of growing stock on commercial forest land by species and ownership class, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All owners	Ownership class							
		Misc. federal	State	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:									
Red pine	492	—	492	—	—	—	—	—	—
Jack pine	292	—	292	—	—	—	—	—	—
White spruce	390	—	—	—	—	390	—	—	—
Black spruce	63	—	63	—	—	—	—	—	—
Balsam fir	174	—	—	—	174	—	—	—	—
Tamarack	313	—	67	—	151	—	95	—	—
Other	825	—	—	—	270	555	—	—	—
Total	2,549	—	914	—	985	555	95	—	—
HARDWOODS:									
Select white oaks	60,049	84	670	—	51,916	504	5,968	—	907
Select red oaks	15,552	—	—	602	10,874	—	4,076	—	—
Other red oaks	522	—	—	—	433	—	89	—	—
Hickory	376	—	—	—	376	—	—	—	—
Hard maple	7,484	—	—	—	5,345	—	2,139	—	—
Soft maple	3,335	—	—	—	3,335	—	—	—	—
Ash	23,733	—	746	187	17,598	102	4,888	—	212
Balsam poplar	25,779	949	4,287	104	18,294	357	1,680	108	—
Paper birch	3,048	—	108	95	2,455	—	390	—	—
Bigtooth aspen	27	—	—	—	27	—	—	—	—
Quaking aspen	97,199	1,574	11,754	347	73,045	449	9,958	72	—
Basswood	29,510	—	—	—	22,427	70	6,621	—	392
Elm	58,860	168	1,196	82	43,783	—	12,942	—	689
Select hardwoods	1,955	—	—	—	1,689	—	266	—	—
Other hardwoods	32,234	112	2,356	—	26,176	—	3,590	—	—
Total	359,663	2,887	21,117	1,417	277,773	1,482	52,607	180	2,200
All species	362,212	2,887	22,031	1,417	278,758	2,037	52,702	180	2,200

Table 27.—*Net volume of sawtimber on commercial forest land by species and ownership class, Prairie Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All owners	Ownership class							
		Misc. federal	State	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:									
Red pine	3,167	—	3,167	—	—	—	—	—	—
Jack pine	1,100	—	1,100	—	—	—	—	—	—
White spruce	1,794	—	—	—	1,794	—	—	—	—
Tamarack	447	—	—	—	—	—	447	—	—
Other softwoods	1,259	—	—	—	642	617	—	—	—
Total	7,767	—	4,267	—	2,436	617	447	—	—
HARDWOODS:									
Select white oaks	226,880	444	964	—	196,808	1,725	22,585	—	4,354
Select red oaks	63,107	—	—	—	48,195	—	14,912	—	—
Other red oaks	2,403	—	—	—	1,918	—	485	—	—
Hickory	851	—	—	—	851	—	—	—	—
Hard maple	29,372	—	—	—	22,688	—	6,684	—	—
Soft maple	17,241	—	—	—	17,241	—	—	—	—
Ash	100,769	—	—	—	74,465	—	25,491	—	813
Balsam poplar	29,054	260	3,305	643	23,969	—	354	523	—
Paper birch	2,876	—	—	—	2,428	—	448	—	—
Quaking aspen	68,477	1,346	2,095	—	63,474	—	1,562	—	—
Basswood	148,474	—	—	—	115,444	379	30,870	—	1,781
Elm	270,859	973	5,851	—	203,819	—	57,285	—	2,931
Select hardwoods	5,339	—	—	—	3,641	—	1,698	—	—
Other hardwoods	134,628	—	6,716	—	110,067	—	17,845	—	—
Total	1,100,330	3,023	18,931	643	885,008	2,104	180,219	523	9,879
All species	1,108,097	3,023	23,198	643	887,444	2,721	180,666	523	9,879

[1]International ¼-inch rule.

Table 28.—*Net volume of growing stock on commercial forest land by forest type and stand-age class, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Tamarack	130	—	130	—	—	—	—	—	—	—	—	—	—	—
Oak-hickory	57,247	1,495	—	—	2,098	4,286	2,391	7,457	9,831	15,172	12,412	2,105	—	—
Elm-ash-cottonwood	44,512	265	—	4,104	4,970	9,737	7,959	6,993	1,600	731	5,150	1,485	1,518	—
Maple-basswood	123,992	58	1,362	2,383	1,127	5,771	16,175	29,634	28,205	11,979	11,514	14,896	888	—
Aspen	122,478	10,915	10,898	10,587	30,039	40,158	10,047	5,651	3,510	673	—	—	—	—
Balsam poplar	13,302	1,737	432	1,044	3,511	4,203	593	1,782	—	—	—	—	—	—
Nonstocked	551	225	80	—	106	140	—	—	—	—	—	—	—	—
All types	362,212	14,695	12,902	18,118	41,851	64,295	37,165	51,517	43,146	28,555	29,076	18,486	2,406	—

Table 29.—*Net volume of sawtimber on commercial forest land by forest type and stand-age class, Prairie Unit, Minnesota, 1977*
(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Oak-hickory	209,804	6,631	—	—	3,859	12,054	4,924	25,167	32,237	57,636	56,459	10,837	—	—
Elm-ash-cottonwood	179,115	895	—	12,055	14,664	39,015	36,257	27,223	6,881	2,949	24,540	6,532	8,104	—
Maple-basswood	588,518	335	4,036	5,592	2,171	23,088	61,595	141,032	143,115	62,895	58,348	81,106	5,205	—
Aspen	116,471	6,999	13,208	9,015	19,096	44,450	11,336	7,923	2,049	2,395	—	—	—	—
Balsam poplar	12,051	551	—	643	4,377	2,687	—	3,793	—	—	—	—	—	—
Nonstocked	2,139	1,722	417	—	—	—	—	—	—	—	—	—	—	—
All types	1,108,098	17,133	17,661	27,305	44,167	121,294	114,112	205,138	184,282	125,875	139,347	98,475	13,309	—

[1]International ¼-inch rule.

Table 30.—*Net volume of short-log trees on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:	101	101	—	—	—	—	—	—	—	—	—
HARDWOODS:											
Select white oaks	3,335	—	522	716	714	205	461	281	382	54	—
Select red oaks	75	—	—	75	—	—	—	—	—	—	—
Hard maple	610	—	169	190	66	—	71	—	114	—	—
Soft maple	198	—	—	126	—	—	72	—	—	—	—
Ash	755	—	238	328	46	97	—	—	—	46	—
Balsam poplar	383	—	346	—	—	—	—	—	—	—	37
Quaking aspen	1,939	—	916	777	246	—	—	—	—	—	—
Basswood	551	—	121	190	146	94	—	—	—	—	—
Elm	1,855	—	678	123	122	118	67	74	380	293	—
Other hardwoods	1,465	—	205	391	106	116	35	—	72	—	540
Total	11,166	—	3,195	2,916	1,446	630	706	355	948	393	577
All species	11,267	101	3,195	2,916	1,446	630	706	355	948	393	577

Table 31.—*Net volume of short-log trees on commercial forest land by species and diameter class, Prairie Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:	574	574	—	—	—	—	—	—	—	—	—
HARDWOODS:											
Selectwhiteoaks	11,542	—	1,907	2,607	2,370	918	1,381	795	1,377	187	—
Select red oaks	224	—	—	224	—	—	—	—	—	—	—
Hard maple	1,583	—	318	513	127	—	146	—	479	—	—
Soft maple	925	—	—	690	—	—	235	—	—	—	—
Ash	2,000	—	706	766	82	198	—	—	—	248	—
Balsam poplar	940	—	457	—	—	—	—	—	—	—	483
Quaking aspen	3,329	—	1,665	1,214	450	—	—	—	—	—	—
Basswood	832	—	292	190	184	166	—	—	—	—	—
Elm	8,038	—	2,928	509	742	482	199	349	1,523	1,306	—
Other hardwoods	9,173	—	1,632	2,305	708	517	243	—	398	—	3,370
Total hardwoods	38,586	—	9,905	9,018	4,663	2,281	2,204	1,144	3,777	1,741	3,853
All species	39,160	574	9,905	9,018	4,663	2,281	2,204	1,144	3,777	1,741	3,853

[1]International ¼-inch rule.

Table 32.—*Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Prairie Unit, Minnesota, 1961 and 1976*

(In thousand cubic feet)

Species	1961[1]	1976
Softwoods	136	114
Hardwoods	11,931	11,820
All species	12,067	11,934

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 33.—*Net annual growth of growing stock on commercial forest land by species and county, Prairie Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All Counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cotton-wood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyoh	Kittson	Lac Qui Parle	Lincoln	Lyon	McLeod	Marshall	Martin	Meeker	Mower
SOFTWOODS																						
Red pine	18	—	—	—	—	—	—	—	—	—	—	—	—	7	—	—	—	—	8	—	—	—
Jack pine	13	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—	6	—	—	—
White spruce	19	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	8	—	—	—
Black spruce	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—
Balsam fir	18	—	—	—	—	—	—	—	—	—	—	—	—	7	—	—	—	—	8	—	—	—
Tamarack	12	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—	—	7	—	—	—
Other softwoods	30	—	3	2	—	1	—	3	—	2	—	—	2	—	—	—	—	—	2	—	1	2
Total	114	—	3	2	—	1	—	3	—	2	—	—	2	26	—	—	—	—	42	—	1	2
HARDWOODS																						
Select white oak	1,086	—	63	27	–5	14	5	24	16	17	12	7	30	99	5	16	17	23	157	8	33	18
Select red oak	441	—	42	25	—	2	—	25	3	16	1	4	14	29	—	5	4	3	43	1	25	18
Other red oaks	13	—	2	1	—	1	—	1	—	1	—	—	—	—	—	—	—	—	—	—	1	1
Hickory	14	—	3	1	—	—	—	1	—	1	—	—	1	—	—	—	—	—	—	—	2	1
Hard maple	492	—	73	18	—	24	—	15	14	10	10	8	3	—	—	3	3	33	9	6	51	14
Soft maple	127	—	14	9	1	—	1	9	2	6	—	1	7	1	1	1	2	1	3	1	4	6
Ash	313	1	8	—	4	15	–1	4	–3	4	7	1	7	36	–4	1	–1	5	78	1	5	4
Balsam poplar	1,266	–2	–6	–4	–4	10	–8	—	–6	1	–1	–4	–2	341	–5	–5	–4	–2	584	–10	1	–2
Paper birch	81	2	3	2	1	3	1	1	1	1	1	—	2	5	1	—	1	1	13	1	1	1
Bigtooth aspen	4	—	—	—	—	2	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	4,592	4	36	19	6	42	14	10	17	8	17	7	15	1,063	16	9	10	13	1,484	17	6	10
Basswood	1,617	7	168	69	11	22	11	56	39	38	8	14	44	35	18	12	24	46	90	18	100	45
Elm	850	5	50	3	13	45	–6	27	9	18	21	—	61	65	–7	3	—	45	187	–1	–27	11
Select hardwoods	57	—	6	2	—	—	1	2	2	1	—	—	1	2	2	—	1	2	3	1	2	1
Other hardwoods	867	11	38	17	17	25	9	10	18	8	6	4	27	45	17	5	7	7	156	9	14	8
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	11,820	28	500	189	44	205	27	185	112	130	83	42	210	1,721	44	42	64	177	2,807	52	218	136
All species	11,934	28	503	191	44	206	27	188	112	132	83	42	212	1,747	44	42	64	177	2,849	52	219	138

(Table 33 continued on next page)

(Table 33 continued)

Species	Murray	Nicollet	Nobles	Norman	Pennington	Pipestone	Polk	Pope	Red Lake	Redwood	Renville	Rock	Sibley	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
SOFTWOODS																					
Red pine	—	—	—	—	1	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	—	1	2	—	4	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	1	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	—	1	—	1	—	—	1	1	1	1	2	—	2	1	—	—	—	—	—	—	1
Total	—	1	—	2	5	—	9	2	4	1	2	—	2	1	—	—	—	—	—	—	1
HARDWOODS																					
Select white oaks	2	36	1	42	74	1	161	5	72	13	21	–1	37	16	2	7	–3	10	1	–1	22
Select red oaks	1	21	—	6	15	1	32	6	20	9	12	—	23	13	—	2	—	11	—	—	9
Other red oaks	—	1	—	—	—	—	1	—	—	—	1	—	1	1	—	—	—	—	—	—	—
Hickory	—	1	—	—	—	—	1	—	—	—	1	—	1	—	—	—	—	—	—	—	—
Hard maple	1	51	—	—	4	—	40	5	3	2	13	—	36	16	—	—	—	18	—	—	9
Soft maple	—	4	—	3	3	—	11	5	5	4	5	—	8	3	—	1	—	1	—	—	4
Ash	1	1	1	16	21	1	51	7	20	5	—	—	6	4	2	3	1	2	–3	—	4
Balsam poplar	–1	7	–3	23	130	–1	156	8	129	–7	–6	—	–4	–1	–1	–7	—	2	—	1	13
Paper birch	—	2	—	6	4	—	14	1	3	1	1	—	2	1	—	1	—	1	—	—	2
Bigtooth aspen	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	2	24	4	206	399	3	610	33	345	21	23	—	23	13	6	18	—	4	1	—	34
Basswood	6	103	2	47	48	2	159	19	46	29	44	2	86	40	2	18	1	40	6	1	41
Elm	3	46	1	20	42	2	172	24	44	27	2	2	36	–1	5	13	3	24	–6	1	8
Select hardwoods	—	3	—	2	2	—	7	1	2	1	2	—	3	1	—	1	—	1	—	—	2
Other hardwoods	5	18	3	45	39	1	116	20	28	21	16	4	17	8	2	18	4	7	6	2	19
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	20	210	9	416	781	10	1 532	134	717	126	135	7	275	114	18	75	6	69	5	4	141
All species	20	211	9	418	786	10	1 541	136	721	127	137	7	277	115	18	75	6	69	5	4	142

Table 34.—*Net annual growth of sawtimber on commercial forest land by species and county, Prairie Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All Counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cotton-wood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyoh	Kittson	Lac Qui Parle	Lincoln	Lyon	McLeod	Marshall	Martin	Meeker	Mower	Murray
SOFTWOODS																							
Red pine	93	—	—	—	—	—	—	—	—	—	1	—	—	35	—	—	—	—	44	—	—	—	—
Jack pine	33	—	—	—	—	—	—	—	—	—	—	—	—	12	—	—	—	—	16	—	—	—	—
White spruce	58	—	—	—	—	2	—	—	—	—	—	—	—	7	—	—	—	—	21	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	13	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—	6	—	—	—	—
Other softwoods	28	—	3	2	—	—	—	2	—	2	—	—	2	—	—	—	—	—	1	—	1	2	—
Total	225	—	3	2	—	2	—	2	—	2	1	—	2	59	—	—	—	—	88	—	1	2	—
HARDWOODS																							
Select white oaks	4,515	—	267	119	–18	119	44	102	76	66	84	45	141	320	35	44	38	101	382	58	144	81	11
Select red oaks	2,573	1	258	158	2	13	1	157	19	102	6	13	96	118	2	21	26	16	199	6	144	114	5
Other red oaks	48	—	5	3	—	4	—	2	—	2	2	1	1	—	—	—	—	—	1	—	5	2	—
Hickory	22	—	3	1	—	—	—	2	1	1	—	—	1	—	—	—	—	1	—	—	1	2	—
Hard maple	2,263	—	393	75	—	32	—	62	89	44	14	33	8	—	—	9	13	207	33	34	251	58	4
Soft maple	3,047	1	386	278	3	2	3	290	27	183	1	12	213	7	4	39	40	5	14	4	126	194	—
Ash	1,208	7	79	33	10	39	13	17	33	11	20	7	20	32	24	8	17	30	110	16	32	15	3
Balsam poplar	3,094	12	29	16	25	22	22	—	19	1	6	11	28	450	22	13	15	8	772	30	2	6	4
Paper birch	34	—	1	—	1	2	—	—	—	—	—	—	1	5	—	—	—	—	12	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	6,621	5	191	139	7	–2	35	124	39	78	8	19	93	861	29	35	35	11	1,338	42	53	91	4
Basswood	7,086	27	817	333	37	52	43	276	184	184	21	62	205	120	78	54	111	224	301	74	491	220	29
Elm	2,210	–3	348	68	—	179	–70	212	39	138	94	–15	305	49	–79	3	–26	258	421	–58	–96	94	2
Select hardwoods	253	—	36	20	—	—	—	20	3	13	—	2	12	—	—	3	3	5	1	1	19	15	—
Other hardwoods	6,104	41	260	162	56	108	88	48	152	31	21	35	103	299	148	39	94	48	901	89	78	46	10
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	39,078	91	3,073	1,405	123	570	179	1,312	681	854	277	225	1,227	2,261	263	268	366	914	4,485	296	1,250	938	72
All species	39,303	91	3,076	1,407	123	572	179	1,314	681	856	278	225	1,229	2,320	263	268	366	914	4,573	296	1,251	940	72

[1]International ¼-inch rule.

(Table 34 continued on next page)

(Table 34 continued)

Species	Nicollet	Nobles	Norman	Pennington	Pipe-stone	Polk	Pope	Red Lake	Redwood	Renville	Rock	Sibley	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
SOFTWOODS																				
Red pine	—	—	1	4	—	5	—	3	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	—	—	—	2	—	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	4	6	—	14	—	4	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	1	—	1	—	—	2	1	2	1	1	—	2	1	—	—	—	—	—	—	1
Total	1	—	6	13	—	24	1	10	1	1	—	2	1	—	—	—	—	—	—	1
HARDWOODS																				
Select white oaks	186	9	213	253	9	693	23	237	68	115	-3	157	81	12	44	-16	39	5	-5	136
Select red oaks	119	—	36	92	5	197	40	129	58	78	—	140	78	—	12	—	58	1	—	53
Other red oaks	4	—	—	—	—	4	1	—	1	2	—	3	2	—	—	—	2	—	—	1
Hickory	1	—	—	—	—	2	—	1	1	1	—	2	1	—	—	—	—	—	—	—
Hard maple	244	—	—	27	—	173	9	16	9	45	—	201	65	—	1	—	81	—	—	33
Soft maple	87	1	15	21	11	184	67	99	121	139	—	214	103	1	25	1	39	1	—	86
Ash	47	3	59	54	2	216	16	36	18	32	1	45	17	5	18	2	15	7	—	39
Balsam poplar	25	8	226	318	4	492	45	301	30	23	2	15	7	6	27	5	7	—	—	40
Paper birch	—	—	2	3	—	4	1	2	—	—	—	—	—	—	—	—	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	76	10	387	665	10	986	77	673	82	91	-1	112	56	8	43	-3	22	2	-3	93
Basswood	491	6	147	178	9	627	70	179	127	201	7	420	191	6	73	4	194	33	1	179
Elm	-230	-11	-194	-18	5	485	71	35	97	8	4	237	3	14	7	3	-130	-32	5	-12
Select hardwoods	15	—	—	1	1	13	4	6	7	10	—	19	10	—	1	—	7	—	—	6
Other hardwoods	203	15	408	395	8	1 056	77	286	95	166	6	118	43	12	88	12	42	46	2	169
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1 268	41	1 299	1 989	64	5 132	501	2 000	714	911	16	1 683	657	64	339	8	376	63	—	823
All species	1 269	41	1 305	2 002	64	5 156	502	2 010	715	912	16	1 685	658	64	339	8	376	63	—	824

Table 35.—*Net annual growth of growing stock on commercial forest land by species and ownership class, Prairie Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All owners	Ownership class							
		Misc. federal	State	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:									
Red pine	18	—	18	—	—	—	—	—	—
Jack pine	13	—	13	—	—	—	—	—	—
White spruce	19	—	—	—	19	—	—	—	—
Black spruce	4	—	4	—	—	—	—	—	—
Balsam fir	18	—	—	—	18	—	—	—	—
Tamarack	12	—	2	—	6	—	4	—	—
Other softwoods	30	—	1	—	9	20	—	—	—
Total	114	—	38	—	52	20	4	—	—
HARDWOODS:									
Select white oaks	1,086	2	22	—	912	10	120	—	20
Select red oaks	441	—	—	29	296	—	116	—	—
Other red oaks	13	—	—	—	11	—	2	—	—
Hickory	14	—	—	—	14	—	—	—	—
Hard maple	492	—	—	—	347	—	145	—	—
Soft maple	127	—	—	—	127	—	—	—	—
Ash	313	—	27	7	178	3	93	—	5
Balsam poplar	1,266	60	287	6	437	29	440	7	—
Paper birch	81	—	3	5	62	—	11	—	—
Bigtooth aspen	4	—	—	—	4	—	—	—	—
Quaking aspen	4,592	100	997	28	2,478	34	947	8	—
Basswood	1,617	—	—	—	1,197	3	390	—	27
Elm	850	11	45	14	59	—	670	—	51
Select hardwoods	57	—	—	—	54	—	3	—	—
Other hardwoods	867	6	118	—	655	—	88	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—
Total	11,820	179	1,499	89	6,831	79	3,025	15	103
All species	11,934	179	1,537	89	6,883	99	3,029	15	103

Table 36.—*Net annual growth of sawtimber on commercial forest land by species and ownership class, Prairie Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All owners	Ownership class							
		Misc. federal	State	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:									
Red pine	93	—	93	—	—	—	—	—	—
Jack pine	33	—	33	—	—	—	—	—	—
White spruce	58	—	—	—	58	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—
Tamarack	13	—	—	—	—	—	13	—	—
Other softwoods	28	—	—	—	15	13	—	—	—
Total	225	—	126	—	73	13	13	—	—
HARDWOODS:									
Select white oaks	4,515	9	544	—	3,062	30	781	—	89
Select red oaks	2,573	—	—	—	1,582	—	991	—	—
Other red oaks	48	—	—	—	38	—	10	—	—
Hickory	22	—	—	—	22	—	—	—	—
Hard maple	2,263	—	—	—	1,911	—	352	—	—
Soft maple	3,047	—	—	—	3,047	—	—	—	—
Ash	1,208	—	—	—	904	—	292	—	12
Balsam poplar	3,094	8	124	33	2,881	—	15	33	—
Paper birch	34	—	—	—	24	—	10	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—
Quaking aspen	6,621	48	70	—	6,441	—	62	—	—
Basswood	7,086	—	—	—	5,497	15	1,473	—	101
Elm	2,210	62	173	—	–591	—	2,346	—	220
Select hardwoods	253	—	—	—	222	—	31	—	—
Other hardwoods	6,104	—	124	—	4,843	—	1,137	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—
Total	39,078	127	1,035	33	29,883	45	7,500	33	422
All species	39,303	127	1,161	33	29,955	58	7,513	33	422

[1]International ¼-inch rule.

Table 37.—*Net annual growth of growing stock on commercial forest land by species and forest type, Prairie Unit, Minnesota, 1977*
(In thousand cubic feet)

Species	All types	Forest type						
		Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Balsam poplar	Non-stocked
SOFTWOODS:								
Red pine	18	—	—	—	—	18	—	—
Jack pine	13	—	—	—	—	13	—	—
White spruce	19	—	—	—	—	19	—	—
Black spruce	4	4	—	—	—	—	—	—
Balsam fir	18	—	—	—	—	18	—	—
Tamarack	12	2	—	4	—	6	—	—
Other softwoods	30	—	26	—	5	–1	—	—
Total	114	6	26	4	5	73	—	—
HARDWOODS:								
Select white oaks	1,086	—	513	13	263	295	1	1
Select red oaks	441	—	274	—	148	19	—	—
Other red oaks	13	—	9	—	4	—	—	—
Hickory	14	—	12	—	2	—	—	—
Hard maple	492	—	3	—	489	—	—	—
Soft maple	127	—	—	112	15	—	—	—
Ash	313	—	28	96	53	106	27	3
Balsam poplar	1,266	—	17	91	–660	878	940	—
Paper birch	81	—	—	7	14	55	5	—
Bigtooth aspen	4	—	—	—	4	—	—	—
Quaking aspen	4,592	—	70	–48	–55	4,607	106	–88
Basswood	1,617	—	150	43	1,397	27	—	—
Elm	850	—	–163	410	410	123	70	—
Select hardwoods	57	—	32	12	13	—	—	—
Other hardwoods	867	—	27	658	124	45	13	—
Noncommercial species	—	—	—	—	—	—	—	—
Total	11,820	—	972	1,394	2,221	6,155	1,162	–84
All species	11,934	6	998	1,398	2,226	6,228	1,162	–84

Table 38.—*Net annual growth of sawtimber on commercial forest land by species and forest type, Prairie Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All types	Forest type					
		Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Balsam poplar	Non-stocked
SOFTWOODS:							
Red pine	93	—	—	—	93	—	—
Jack pine	33	—	—	—	33	—	—
White spruce	58	—	—	—	58	—	—
Black spruce	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—
Tamarack	13	—	13	—	—	—	—
Other softwoods	28	23	—	5	—	—	—
Total	225	23	13	5	184	—	—
HARDWOODS:							
Select white oaks	4,515	1,019	69	1,484	1,938	—	5
Select red oaks	2,573	1,950	—	623	—	—	—
Other red oaks	48	23	—	25	—	—	—
Hickory	22	16	—	6	—	—	—
Hard maple	2,263	18	—	2,245	—	—	—
Soft maple	3,047	—	3,011	36	—	—	—
Ash	1,208	61	163	927	36	—	21
Balsam poplar	3,094	8	174	62	1,942	908	—
Paper birch	34	—	34	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—
Quaking aspen	6,621	782	—	–288	5,322	804	1
Basswood	7,086	758	92	6,195	41	—	—
Elm	2,210	–486	1,174	1,197	219	106	—
Select hardwoods	253	200	9	44	—	—	—
Other hardwoods	6,104	30	3,474	2,551	49	—	—
Noncommercial species	—	—	—	—	—	—	—
Total	39,078	4,379	8,200	15,107	9,547	1,818	27
All species	39,303	4,402	8,213	15,112	9,731	1,818	27

[1]International ¼-inch rule.

Table 39.—*Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Prairie Unit, Minnesota, 1976*
(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	6	—	6	—	—	—	—	—	—	—	—	—	—	—
Oak-hickory	998	–100	—	—	–75	137	100	445	318	43	93	37	—	—
Elm-ash-cottonwood	1,398	8	—	191	204	275	226	196	57	27	140	31	43	—
Maple-basswood	2,226	4	28	–41	54	–454	833	892	793	480	–134	–265	36	—
Aspen	6,228	–501	975	835	1,997	1,956	535	277	135	19	—	—	—	—
Paper birch	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam poplar	1,162	118	31	88	538	251	44	92	—	—	—	—	—	—
Nonstocked	–84	3	1	—	–98	10	—	—	—	—	—	—	—	—
All types	11,934	–468	1,041	1,073	2,620	2,175	1,738	1,902	1,303	569	99	–197	79	—

Table 40.—*Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Prairie Unit, Minnesota, 1976*
(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oak-hickory	4,402	–352	—	—	608	475	661	1,063	1,020	405	332	190	—	—
Elm-ash-cottonwood	8,213	23	—	300	317	4,343	1,210	1,094	130	100	418	108	170	—
Maple-basswood	15,112	22	–76	–774	691	609	3,021	4,970	5,758	3,601	–1,306	–1,611	207	—
Aspen	9,731	–507	441	320	2,313	4,972	1,003	1,084	58	47	—	—	—	—
Paper birch —	—	—	—	—	—	—	—	—	—	—	—	—	—	
Balsam poplar	1,818	19	—	33	141	95	—	1,530	—	—	—	—	—	—
Nonstocked	27	22	5	—	—	—	—	—	—	—	—	—	—	—
All types	39,303	–773	370	–121	4,070	10,494	5,895	9,741	6,966	4,153	–556	–1,313	377	—

[1]International ¼-inch rule

Table 41.—*Timber removals from growing stock and sawtimber on commercial forest land by species, Prairie Unit, Minnesota, 1962 and 1976*

Species	Growing stock		Sawtimber	
	1962	1976	1962	1976
	Thousand cubic feet		*Thousand board feet*[1]	
SOFTWOODS:				
White pine	3	—	17	—
Red pine	12	20	38	64
Jackpine	5	9	9	17
Spruce	52	16	165	33
Balsam fir	62	6	87	—
Tamarack	19	49	55	87
Northern white-cedar	—	18	—	24
Other softwoods	23	38	19	32
Total	176	156	390	257
HARDWOODS:				
White oak	870	1,378	2,589	2,623
Red oak	425	447	1,305	989
Yellow birch	1	—	5	—
Hard maple	102	228	255	479
Soft maple	73	138	231	394
Ash	313	631	752	1,350
Paper birch	50	55	65	14
Aspen	1,676	1,444	2,296	537
Basswood	389	676	1,339	1,889
Elm	758	1,936	2,491	5,081
Other hardwoods	1,410	1,638	4,579	4,260
Total	6,067	8,571	15,907	17,616
All species	6,243	8,727	16,297	17,873

[1]International ¼-inch rule.

Table 42.—*Timber removals from growing stock on commercial forest land by species and county, Prairie Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cottonwood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyohi	Kittson	Lac qui Parle	Lincoln	Lyon
SOFTWOODS																	
Red pine	20	—	—	—	—	—	—	—	—	—	—	—	—	7	—	—	—
Jack pine	9	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—
White spruce	15	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—
Black spruce	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam Fir	6	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—
Tamarack	49	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—
Northern white-cedar	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	38	—	43	3	—	—	—	3	—	2	—	—	3	2	—	—	—
Total	156	—	43	3	—	1	—	3	—	2	—	—	3	21	—	—	—
HARDWOODS:																	
Select white oak	1,378	7	102	46	8	40	6	37	32	32	17	10	70	68	11	9	12
Select red oak	431	—	44	25	1	1	—	24	8	18	1	3	17	9	1	3	4
Other red oak	16	—	1	1	—	1	—	1	—	1	1	—	—	—	—	—	—
Hickory	11	—	1	1	—	—	—	1	—	1	—	—	1	—	—	—	—
Hard maple	228	—	29	10	—	5	—	8	8	7	3	3	4	1	—	1	1
Soft maple	138	—	12	7	—	—	1	5	5	6	—	1	6	1	1	1	1
Ash	631	9	31	14	10	10	12	8	13	6	13	11	11	19	18	9	16
Balsam poplar	372	2	5	2	4	4	3	—	3	1	1	1	5	63	3	1	2
Paper birch	55	1	3	1	1	2	—	1	1	1	1	—	2	3	1	1	1
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	1,444	6	23	11	11	19	9	4	10	5	11	4	16	228	11	5	9
Basswood	676	3	76	30	4	4	5	24	18	16	3	6	21	7	8	5	11
Elm	1,936	18	130	60	24	18	27	39	48	32	26	25	49	23	39	21	37
Cottonwood	578	2	1	1	25	45	3	2	84	1	3	3	2	—	3	3	3
Black walnut	12	—	2	5	—	—	—	—	1	—	—	—	—	—	—	—	—
Other hardwoods	665	10	41	22	14	12	11	13	18	10	8	7	25	19	18	8	16
Total	8,571	58	501	236	102	161	77	167	249	137	88	74	229	441	114	67	113
All species	8,727	58	505	239	102	162	77	170	249	139	88	74	232	462	114	67	113

(Table 42 continued on next page)

(Table 42 continued)

Species	McLeod	Marshall	Martin	Meeker	Mower	Murray	Nicollet	Nobles	Norman	Pennington	Pipestone	Polk	Pope	Red Lake	Redwood	Renville	Rock	Sibley
SOFTWOODS:																		
Red pine	—	10	—	—	—	—	—	—	—	1	—	1	—	1	—	—	—	—
Jack pine	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	7	—	—	—	—	—	—	1	1	—	3	—	1	—	—	—	—
Black spruce	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam Fir	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	7	—	—	—	—	—	—	—	2	—	36	—	—	—	—	—	—
Northern white-cedar	—	9	—	—	—	—	—	—	—	—	—	9	—	—	—	—	—	—
Other softwoods	—	3	—	1	2	—	1	—	—	—	—	3	2	2	1	2	—	1
Total	—	45	—	1	2	—	1	—	1	4	—	52	2	4	1	2	—	1
HARDWOODS:																		
Select white oak	46	136	12	65	33	4	61	2	44	43	1	119	31	35	22	43	1	58
Select red oak	12	15	1	37	22	1	39	—	2	5	1	20	10	10	6	18	—	24
Other red oak	—	—	—	1	1	—	2	—	—	—	—	1	—	—	—	1	—	1
Hickory	1	—	—	1	1	—	1	—	—	—	—	1	—	—	—	—	—	1
Hard maple	13	3	2	23	8	1	29	—	1	1	—	9	4	1	1	9	—	17
Soft maple	16	5	1	12	6	—	9	—	1	1	—	9	4	1	3	6	—	6
Ash	23	44	15	27	7	10	26	10	16	18	7	58	10	13	17	15	7	17
Balsam poplar	1	108	4	1	1	1	3	1	18	28	1	47	7	26	5	3	1	2
Paper birch	1	7	1	1	1	—	1	—	2	2	—	7	1	1	1	1	—	2
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	8	390	13	6	5	2	14	4	74	117	1	196	26	108	16	14	1	13
Basswood	45	18	7	54	20	2	67	1	9	11	1	36	7	10	13	20	1	39
Elm	219	61	33	154	35	19	99	18	35	32	12	163	27	24	45	51	11	73
Cottonwood	137	3	3	63	1	3	8	3	31	1	2	81	1	—	6	5	2	4
Black walnut	—	—	—	—	—	—	2	—	—	—	—	—	—	—	2	—	—	—
Other hardwoods	8	69	11	16	11	5	22	4	21	19	3	59	17	14	19	21	3	19
Total	530	859	103	461	152	48	383	43	254	278	29	806	145	243	156	207	27	276
All species	530	904	103	462	154	48	384	43	255	282	29	858	147	247	157	209	27	277

(Table 42 continued on next page)

(Table 42 continued)

Species	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
SOFTWOODS:								
Red pine	—	—	—	—	—	—	—	—
Jack pine	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—
Balsam Fir	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—
Other softwoods	2	—	—	—	—	—	—	1
Total	2	—	—	—	—	—	—	1
HARDWOODS:								
Select white oak	28	3	13	2	24	2	12	31
Select red oak	18	—	2	—	19	—	2	8
Other red oak	1	—	—	—	1	—	—	1
Hickory	—	—	—	—	—	—	—	—
Hard maple	10	—	—	—	12	—	1	3
Soft maple	2	—	1	—	4	1	—	3
Ash	9	8	16	7	9	7	1	24
Balsam poplar	1	1	4	1	1	—	1	5
Paper birch	1	1	1	—	1	—	—	2
Bigtooth aspen	—	—	—	—	—	—	—	—
Quaking aspen	7	4	15	2	4	1	1	20
Basswood	20	1	7	1	24	3	—	18
Elm	35	16	34	13	37	16	2	56
Cottonwood	3	3	23	3	3	2	1	5
Black walnut	—	—	—	—	—	—	—	—
Other hardwoods	9	4	16	6	8	7	1	21
Total	144	41	132	35	147	39	22	197
All species	146	41	132	35	147	39	22	198

Table 43.—*Timber removals from sawtimber on commercial forest land by species and county, Prairie Unit, Minnesota, 1976*
(In thousand board feet)[1]

Species	All counties	Big Stone	Blue Earth	Brown	Chippewa	Clay	Cottonwood	Dodge	Faribault	Freeborn	Grant	Jackson	Kandiyohi	Kittson	Lac qui Parle	Lincoln	Lyon
SOFTWOODS																	
Red pine	64	—	—	—	—	—	—	—	—	—	—	—	—	23	—	—	—
Jack pine	17	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	—
White spruce	33	—	—	—	—	2	—	—	—	—	—	—	—	2	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam Fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	87	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—
Northern white-cedar	24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	32	—	3	2	—	—	—	2	—	2	—	—	2	2	—	—	—
Total	257	—	3	2	—	2	—	2	—	2	—	—	2	38	—	—	—
HARDWOODS																	
Select white oak	2,623	13	190	85	15	69	11	68	58	56	32	19	126	121	21	17	23
Select red oak	948	—	88	52	2	2	—	54	15	33	2	6	30	18	2	6	8
Other red oak	41	—	2	2	—	2	—	2	—	2	2	—	—	—	—	—	—
Hickory	13	—	1	1	—	—	—	1	—	1	—	—	1	—	—	—	—
Hard maple	479	—	55	17	—	10	—	15	14	12	6	6	6	2	—	2	2
Soft maple	394	—	26	15	—	—	3	12	11	12	—	3	13	3	3	3	3
Ash	1,350	14	66	30	17	21	22	16	27	13	24	17	21	40	31	15	27
Balsam poplar	218	1	3	1	2	2	2	—	2	1	1	1	3	36	2	1	1
Paper birch	14	—	1	—	—	1	—	—	—	—	—	—	1	1	—	—	—
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	537	2	8	4	4	7	3	1	4	2	4	1	6	83	4	2	3
Basswood	1,889	8	192	76	10	10	13	61	46	41	8	15	51	18	20	13	28
Elm	5,081	32	293	133	45	41	51	87	105	70	48	44	101	53	75	38	70
Cottonwood	2,622	3	2	2	113	224	4	7	417	2	3	4	4	—	4	3	5
Black walnut	76	—	13	25	—	—	—	—	9	—	—	—	—	—	—	—	—
Other hardwoods	1,331	18	84	44	27	25	21	27	36	19	14	12	51	40	36	13	31
Total	17,616	91	1,024	487	235	414	130	351	744	264	144	128	414	415	198	113	201
All species	17,873	91	1,027	489	235	416	130	353	744	266	144	128	416	453	198	113	201

[1]International ¼-inch rule.

(Table 43 continued on next page)

(Table 43 continued)

Species	McLeod	Marshall	Martin	Meeker	Mower	Murray	Nicollet	Nobles	Norman	Pennington	Pipestone	Polk	Pope	Red Lake	Redwood	Renville	Rock	Sibley
SOFTWOODS:																		
Red pine	—	32	—	—	—	—	—	—	—	3	—	3	—	3	—	—	—	—
Jack pine	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	—	16	—	—	—	—	—	—	2	2	—	7	—	2	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam Fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	5	—	—	—	—	—	—	—	1	—	78	—	—	—	—	—	—
Northern white-cedar	—	11	—	—	—	—	—	—	—	—	—	13	—	—	—	—	—	—
Other softwoods	—	2	—	1	2	—	1	—	—	—	—	2	2	2	1	2	—	1
Total	—	75	—	1	2	—	1	—	2	6	—	103	2	7	1	2	—	1
HARDWOODS:																		
Select white oak	105	275	23	151	57	8	133	4	78	79	2	219	54	64	42	73	2	105
Select red oak	35	30	2	92	47	2	121	—	4	10	2	41	17	19	12	32	—	47
Other red oak	1	—	—	4	3	—	6	—	—	—	—	3	—	—	—	2	—	2
Hickory	1	—	—	1	1	—	1	—	—	—	—	2	—	—	—	—	—	2
Hard maple	26	5	4	42	14	2	81	—	1	2	—	17	6	3	2	16	—	38
Soft maple	69	9	3	51	11	—	34	—	3	3	—	19	7	3	10	12	—	15
Ash	83	93	25	93	15	13	75	14	34	37	9	147	21	29	29	31	10	36
Balsam poplar	1	61	2	1	1	1	2	1	10	16	1	26	4	15	3	2	1	1
Paper birch	—	3	—	—	—	—	—	—	1	1	—	3	—	—	—	—	—	1
Bigtooth aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quaking aspen	8	142	5	8	2	1	5	1	28	43	—	74	9	40	6	5	—	5
Basswood	175	45	18	162	54	5	223	3	23	30	3	91	19	25	35	49	3	99
Elm	962	140	63	581	74	30	285	28	80	72	19	507	54	56	98	113	15	172
Cottonwood	685	3	4	311	2	4	38	4	155	1	3	394	2	1	15	22	3	20
Black walnut	—	—	—	—	—	—	9	—	—	—	—	—	—	—	15	—	—	—
Other hardwoods	17	144	22	31	21	8	46	7	44	40	5	123	33	29	37	41	5	40
Total	2,168	950	171	1,528	302	74	1,059	62	461	334	44	1,266	226	284	304	398	39	583
All species	2,168	1,025	171	1,529	304	74	1,060	62	463	340	44	1,769	228	291	305	400	39	584

(Table 43 continued on next page)

(Table 43 continued)

Species	Steele	Stevens	Swift	Traverse	Waseca	Watonwan	Wilkin	Yellow Medicine
SOFTWOODS								
Red pine	—	—	—	—	—	—	—	—
Jack pine	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—
Balsam Fir	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—
Other softwoods	2	—	—	—	—	—	—	1
Total	2	—	—	—	—	—	—	1
HARDWOODS								
Select white oak	54	6	25	4	56	4	17	59
Select red oak	43	—	4	—	49	—	5	16
Other red oak	3	—	—	—	3	—	—	2
Hickory	—	—	—	—	—	—	—	—
Hard maple	27	—	—	—	39	—	1	6
Soft maple	10	—	3	—	14	3	—	6
Ash	21	13	27	11	26	11	2	44
Balsam poplar	1	1	2	1	1	—	1	3
Paper birch	—	—	—	—	—	—	—	1
Bigtooth aspen	—	—	—	—	—	—	—	—
Quaking aspen	2	1	5	1	1	—	—	7
Basswood	61	3	18	3	79	8	—	45
Elm	86	25	65	20	102	29	4	115
Cottonwood	12	3	104	3	18	3	1	14
Black walnut	2	—	—	—	3	—	—	—
Other hardwoods	18	6	32	10	16	13	2	43
Total	340	58	285	53	407	71	33	363
All species	342	58	285	53	407	71	33	364

[1]International ¼-inch rule.

Table 44.—*Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Prairie Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						*Thousand board feet*[1]					
Roundwood Products:												
Pulpwood	34	—	—	34	—	—	77	—	—	77	—	—
Saw logs	869	—	—	—	2	867	4,675	—	—	—	12	4,663
Fuelwood	1,119	—	—	18	17	1,084	1,563	—	—	24	24	1,515
Posts	30	—	—	—	—	30	62	—	—	—	—	62
Veneer logs	46	—	—	—	—	46	331	—	—	—	—	331
Poles	—	—	—	—	—	—	—	—	—	—	—	—
Other[2]	—	—	—	—	—	—	—	—	—	—	—	—
All products	2,098	—	—	52	19	2,027	6,708	—	—	101	36	6,571
Logging residue	167	—	—	1	—	166	552	—	—	—	—	552
Other removals	6,462	9	16	78	1,425	4,934	10,613	17	33	106	501	9,956
Total removals	8,727	9	16	131	1,444	7,127	17,873	17	33	207	537	17,079

[1]International ¼-inch rule.

[2]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 45.—*Timber removals from growing stock by ownership class and softwoods and hardwoods, Prairie Unit, Minnesota, 1976*

(In thousand cubic feet)

Ownership class	All species	Softwoods	Hardwoods
National forest	—	—	—
Other federal	317	1	316
State	5	(1)	5
County	—	—	—
Forest industry	—	—	—
Farmer and miscellaneous private	8,405	155	8,250
All ownerships	8,727	156	8,571

[1]Small quantity rounded off to zero.

Table 46.—*Timber removals from sawtimber by ownership class and softwoods and hardwoods, Prairie Unit, Minnesota, 1976*

(In thousand board feet)[1]

Ownership class	All species	Softwoods	Hardwoods
National forest	—	—	—
Other federal	522	2	520
State	17	(2)	17
County	—	—	—
Forest industry	—	—	—
Farmer and miscellaneous private	17,334	255	17,079
All ownerships	17,873	257	17,616

[1]International ¼-inch rule.

[2]Small quantity rounded off to zero.

Table 47.—*Annual mortality of growing stock on commercial forest land by species and cause, Prairie Unit, Minnesota, 1976*
(In thousand cubic feet)

Species	All causes	Cause				
		Insects	Disease	Fire	Weather	Unknown and other
SOFTWOODS:						
White pine	—	—	—	—	—	—
Red pine	—	—	—	—	—	—
Jack pine	—	—	—	—	—	—
White spruce	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—
Tamarack	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—
Other softwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
HARDWOODS:						
Select white oaks	342	—	—	—	342	—
Select red oaks	—	—	—	—	—	—
Other red oaks	—	—	—	—	—	—
Hickory	—	—	—	—	—	—
Yellow birch	—	—	—	—	—	—
Hard maple	—	—	—	—	—	—
Soft maple	—	—	—	—	—	—
Ash	196	—	—	—	—	196
Balsam poplar	692	—	692	—	—	—
Paper birch	—	—	—	—	—	—
Bigtooth aspen	—	—	—	—	—	—
Quaking aspen	2,777	—	1,501	1,154	—	122
Basswood	—	—	—	—	—	—
Elm	2,223	—	2,223	—	—	—
Select hardwoods	—	—	—	—	—	—
Other hardwoods	—	—	—	—	—	—
Noncommercial species	—	—	—	—	—	—
Total	6,230	—	4,416	1,154	342	318
All species	6,230	—	4,416	1,154	342	318

Table 48.—*Annual mortality of growing stock on commercial forest land by species and cause, Prairie Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All causes	Cause	
		Disease	Weather
SOFTWOODS:			
White pine	—	—	—
Red pine	—	—	—
Jack pine	—	—	—
White spruce	—	—	—
Black spruce	—	—	—
Balsam fir	—	—	—
Tamarack	—	—	—
Northern white-cedar	—	—	—
Other softwoods	—	—	—
Total	—	—	—
HARDWOODS:			
Select white oaks	1,820	—	1,820
Select red oaks	—	—	—
Other red oaks	—	—	—
Hickory	—	—	—
Yellow birch	—	—	—
Hard maple	—	—	—
Soft maple	—	—	—
Ash	—	—	—
Balsam poplar	—	—	—
Paper birch	—	—	—
Bigtooth aspen	—	—	—
Quaking aspen	3,219	3,219	—
Basswood	—	—	—
Elm	10,772	10,772	—
Select hardwoods	—	—	—
Other hardwoods	—	—	—
Noncommercial species	—	—	—
Total	15,811	13,991	1,820
All species	15,811	13,991	1,820

[1]International ¼-inch rule.

Table 49.—*Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Prairie Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National forest	—	—	—	—	—	—
Bureau of land mgmt.	—	—	—	—	—	—
Indian	—	—	—	—	—	—
Miscellaneous federal	—	—	—	—	—	—
State	115	—	115	—	—	—
County and municipal	—	—	—	—	—	—
Forest industry	—	—	—	—	—	—
Farmer	6,115	—	6,115	15,811	—	15,811
Farmer-owned leased	—	—	—	—	—	—
Misc.—private-corp.	—	—	—	—	—	—
Misc.—private-indiv.	—	—	—	—	—	—
Misc.—priv.-corp., leased	—	—	—	—	—	—
Misc.—priv.-ind., leased	—	—	—	—	—	—
All owners	6,230	—	6,230	15,811	—	15,811

[1] International ¼-inch rule.

Table 50.—*Output of timber products by source of material and softwoods and hardwoods, Prairie Unit, Minnesota, 1975*

Product and species group	Standard unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*
Pulpwood:	Standard								
Softwood	cords	457	35	444	34	13	1	—	—
Hardwood		506	40	—	—	—	—	506	40
Total		963	75	444	34	13	1	506	40
Fuelwood:	Standard								
Softwood	cords	586	40	264	18	308	21	14	1
Hardwood		38,840	2,619	16,367	1,101	20,173	1,357	2,300	161
Total		39,426	2,659	16,631	1,119	20,481	1,378	2,314	162
Posts:	Thousand								
Softwood	pieces	—	—	—	—	—	—	—	—
Hardwood		46	48	29	30	17	18	—	—
Total		46	48	29	30	17	18	—	—
Veneer logs:	Thousand								
Softwood	board feet[1]	—	—	—	—	—	—	—	—
Hardwood		346	48	332	46	14	2	—	—
Total		346	48	332	46	14	2	—	—
Poles:	Pieces								
Softwood		—	—	—	—	—	—	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		—	—	—	—	—	—	—	—
Saw logs:	Thousand								
Softwood	board feet[1]	—	—	—	—	—	—	—	—
Hardwood		5,230	900	5,050	869	180	31	—	—
Total		5,230	900	5,050	869	180	31	—	—
Other[2]:	Thousand								
Softwood	cubic feet	—	—	—	—	—	—	—	—
Hardwood		51	51	—	—	—	—	51	51
Total		51	51	—	—	—	—	51	51
All products:	Thousand								
Softwood	cubic feet	75	75	52	52	22	22	1	1
Hardwood		3,706	3,706	2,046	2,046	1,408	1,408	252	252
Total		3,781	3,781	2,098	2,098	1,430	1,430	253	253

[1]International ¼-inch rule.

[2]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.—*Forest products harvested, by ownership class and product, Prairie Unit, Minnesota, 1975*

Ownership class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*[2]Thousand board feet*	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
Federal:						
National forest:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Other federal:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
State:						
Softwoods	2	—	—	—	—	—
Hardwoods	—	15	52	—	—	—
Total	2	15	52	—	—	—
County:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Private:						
Forest industry:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Farm and other:						
Softwoods	455	—	572	—	—	—
Hardwoods	—	5,215	36,488	46	—	48
Total	455	5,215	37,060	46	—	48
All owners:						
Softwoods	457	—	572	—	—	—
Hardwoods	—	5,230	36,540	46	—	48
Total	457	5,230	37,112	46	—	48

[1] Standard cords, rough wood basis.

[2] International ¼-inch rule.

Table 52.—*Volume of primary plant residue, by kind of material and type of use, Prairie Unit, Minnesota, 1975*
(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	—	—	—	—	—	—	—	—
Industrial fuel	—	—	—	—	—	—	—	—
Domestic fuel	0.6	160.6	0.6	154.8	—	5.8	0.4	98.3
Miscellaneous[5]	—	51.1	—	0.5	—	50.6	—	0.3
Not used[6]	3.4	86.6	1.9	31.4	1.5	55.2	1.2	23.1
Total	4.0	298.3	2.5	186.7	1.5	111.6	1.6	121.7

[1]Suitable for chipping such as slabs, edging, veneer cores, etc.

[2]Not suitable for chipping such as sawdust, veneer clippings, etc.

[3]Does not include bark disposal at pulpmills.

[4]For manufacture of pulp, hardboard or roofing felt.

[5]Livestock bedding, mulch, small dimension, and speciality items.

[6]Includes residue burned as waste.

Table 53.—*Timber products output from roundwood, by species and product, Prairie Unit, Minnesota, 1975*

Species	Saw logs		Veneer logs		Pulpwood		Fuelwood		Poles		Posts		Other products	All products
	[1]Thousand board feet	[2]Thousand cubic feet	[1]Thousand board feet	[2]Thousand cubic feet	Cords	[2]Thousand cubic feet	Cords	[2]Thousand cubic feet	Pieces	[2]Thousand cubic feet	Thousand pieces	[2]Thousand cubic feet	[2]Thousand cubic feet	[2]Thousand cubic feet
SOFTWOODS														
White pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Red pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Jack pine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	—	—	—	—	457	35	—	—	—	—	—	—	—	35
Northern white-cedar	—	—	—	—	—	—	572	39	—	—	—	—	—	39
Total	—	—	—	—	457	35	572	39	—	—	—	—	—	74
HARDWOODS														
White oak	190	31	10	1	—	—	7,353	514	—	—	29	31	—	577
Red oak	177	29	29	3	—	—	2,168	145	—	—	17	17	—	194
Hickory	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	66	10	26	3	—	—	1,525	97	—	—	—	—	—	110
Soft maple	129	21	14	2	—	—	1,296	83	—	—	—	—	—	106
Ash	215	36	—	—	—	—	5,542	372	—	—	—	—	—	408
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Paper birch	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aspen	16	2	—	—	—	—	572	37	—	—	—	—	—	39
Basswood	288	47	41	6	—	—	310	9	—	—	—	—	—	62
Elm	1,705	297	78	11	—	—	12,557	873	—	—	—	—	—	1,181
Black walnut	35	5	44	6	—	—	—	—	—	—	—	—	—	11
Cottonwood	2,409	422	104	16	—	—	2,611	165	—	—	—	—	—	603
Other hardwoods	—	—	—	—	—	—	2,606	163	—	—	—	—	—	163
Total	5,230	900	346	48	—	—	36,540	2,458	—	—	46	48	—	3,454
All species	5,230	900	346	48	457	35	37,112	2,497	—	—	46	48	—	3,528

[1]International ¼-inch rule

[2]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.

Table 54.—*Sampling errors*[1] *for estimates smaller than Unit totals of volume, net growth, and removals and of area of commercial forest land in Minnesota's Prairie Unit, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	*Thousand acres*	*Million cubic feet*			*Million board feet*		
1	5,100.1	8,539.6	596.7	1,372.5	65,750.2	2,643.3	2,517.8
2	1,275.0	2,134.9	149.2	343.1	16,437.5	660.8	629.4
3	566.7	948.8	66.3	152.5	7,305.6	293.7	279.8
4	318.8	533.7	37.3	85.8	4,109.4	165.2	157.4
5	204.0	341.6	23.9	54.9	2,630.0	105.7	100.7
10	51.0	85.4	6.0	13.7	657.5	26.4	25.2
15	22.7	37.9	2.7	6.1	292.2	11.7	11.2
20	12.7	21.3	1.5	3.4	164.4	6.6	6.3
25	8.2	13.7	0.9	2.2	105.2	4.2	4.0
50	2.0	3.4	0.2	0.5	26.3	1.1	1.0
100	0.5	0.9	0.1	0.1	6.5	0.3	0.3

[1]At the 68% probability level.

☆ U.S. Government Printing Office: 1980—669-142/42 Region No. 6

Hahn, Jerold T., and W. Brad Smith.
1980. Timber resource of Minnesota's Prairie Unit, 1977. U.S. Department of Agriculture Forest Service, Resource bulletin NC-45, 66 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The fourth inventory of Minnesota's Prairie Unit shows that although commercial forest area decreased 31.7 percent between 1962 and 1977, growing-stock volume increased 22 percent. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

KEY WORDS: timber volume, growth, utilization, forest area.

Hahn, Jerold T., and W. Brad Smith.
1980. Timber resource of Minnesota's Prairie Unit, 1977. U.S. Department of Agriculture Forest Service, Resource bulletin NC-45, 66 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The fourth inventory of Minnesota's Prairie Unit shows that although commercial forest area decreased 31.7 percent between 1962 and 1977, growing-stock volume increased 22 percent. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

KEY WORDS: timber volume, growth, utilization, forest area.

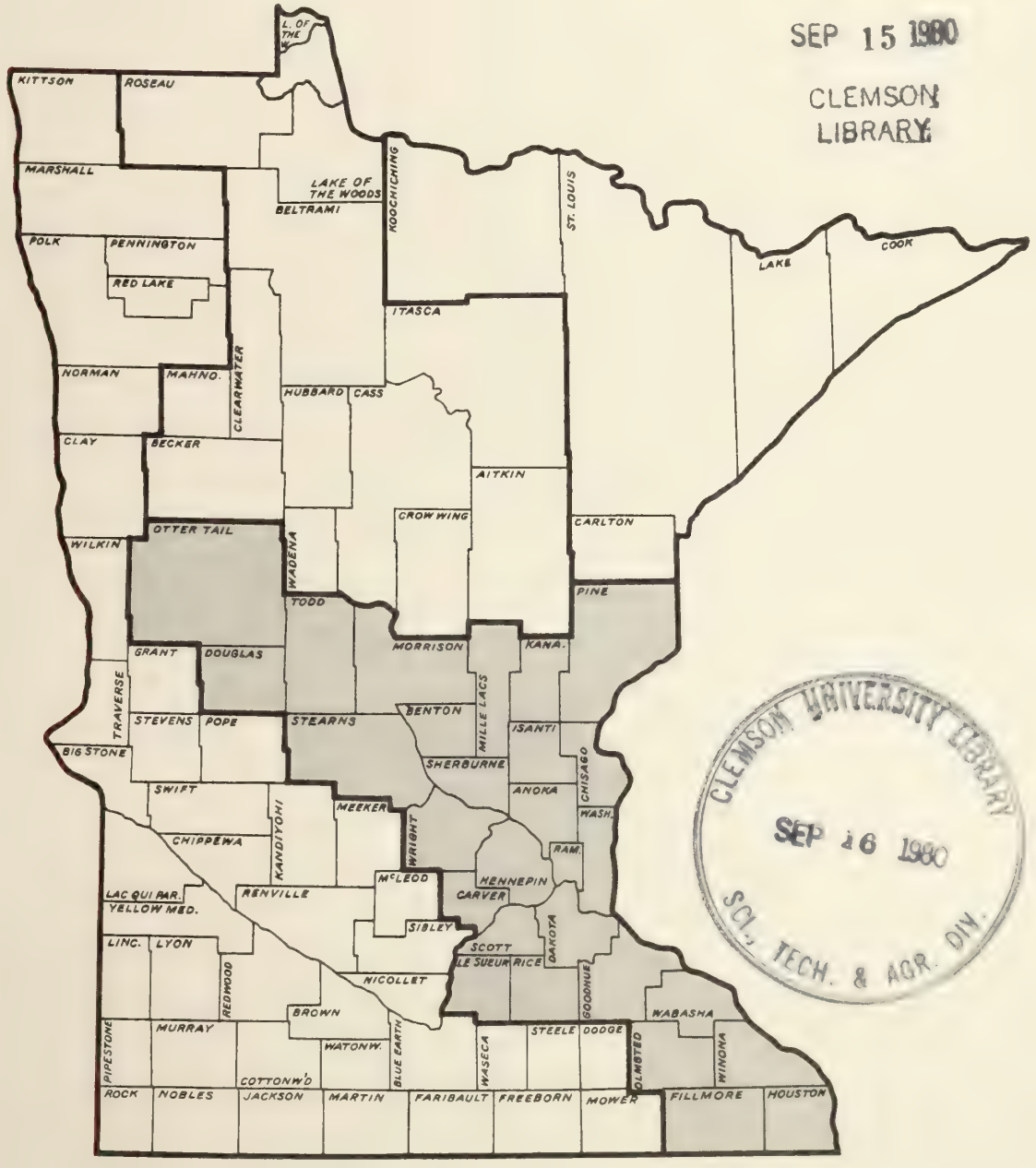
Join Woodsy Owl's fight against pollution...today!

SDA FOREST SERVICE
ESOURCE BULLETIN **NC-46**

Timber resource of Minnesota's central hardwood unit, 1977.

Alexander Vasilevsky and Ronald L. Hackett

GOVT. DOCUMENTS
DEPOSITORY ITEM
SEP 15 1980
CLEMSON
LIBRARY



CLEMSON UNIVERSITY LIBRARY
SEP 16 1980
SCI., TECH. & AGR. DIV.

rth Central Forest Experiment Station
rest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication July 17, 1979

1980

FOREWORD

Resources Evaluation (formerly called Forest Survey) is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974 which was preceeded by the McSweeney-McNary Forest Research Act of 1928. Its objective is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work done in Michigan, Wisconsin, Minnesota, North Dakota, and eastern South Dakota (east of 103rd meridian), Nebraska, Iowa, Illinois, Indiana, Missouri, and Kansas.

Fieldwork for the 1977 Minnesota Forest Survey began in July, 1974 and was completed in July, 1978. Reports on the three previous surveys of Minnesota's timber resource are dated 1936, 1953, and 1962.

Similar Resource Bulletins containing statistical highlights and detailed tables on the timber resource of the other Survey Units in Minnesota (see cover) are also available. These will provide the basis for a comprehensive analysis of the timber resource of the entire State which will be published as a separate report.

More accurate survey information was obtained during the 1977 survey than otherwise would have been feasible because of intensified field sampling made possible by funding and manpower provided the North Central Station by the State Legislature through the Minnesota Department of Natural Resources. The Department also assisted in a canvass of primary wood-using plants in the State, which was used to help estimate the quantity of timber products harvested in Minnesota.

Aerial photos used in the Central Hardwood Unit survey were furnished by the Minnesota Department of Natural Resources and the USDA Agricultural Stabilization and Conservation Service.

CONTENTS

	Page
Highlights	1
Tables	2
Principal tree species groups in the Central Hardwood Unit	4
Appendix	5
Accuracy of survey	5
Survey procedure	5
Comparing Minnesota's Fourth Forest Survey with the Third Survey	6
Metric equivalents of units used in this report	7
Definition of terms	7

TIMBER RESOURCE OF MINNESOTA'S CENTRAL HARDWOOD UNIT, 1977

Alexander Vasilevsky, *Mensurationist,*
and **Ronald L. Hackett,** *Mensurationist*

HIGHLIGHTS

Forest Area

- Forest land occupied 2.1 million acres in 1977 (18 percent of the Unit's land area) as compared to 2.7 million acres (23 percent) in 1962.[1]
- Commercial forest land declined 17 percent from 2.4 million acres in 1962 (86 percent of total forest area) to 2.0 million acres in 1977 (91 percent of the total forest area).
- Pine and Ottertail Counties contain the Unit's largest areas of commercial forest (425,000 and 186,000 million acres, respectively).
- Eighty-three percent (1.6 million acres) of the commercial forest land in the Unit is privately owned. Farmers alone own 58 percent (1.1 million acres) (fig. 1).
- The oak type (571,800 acres), aspen type (560,200), and maple-basswood type (485,800) contain the largest areas in 1977. In 1962 the aspen type (640,000), oak type (600,300), and elm-ash-cottonwood type (414,000) led all others.
- Poletimber stands account for 43 percent of the commercial forest and sawtimber stands account for 40 percent.

[1] *1962 statistics have been adjusted from those published after the 1962 survey to conform to 1977 statistics because of changes in survey unit boundaries and in procedures and definitions. (See Comparing Minnesota's Fourth Forest Survey with the Third Survey in Appendix).*

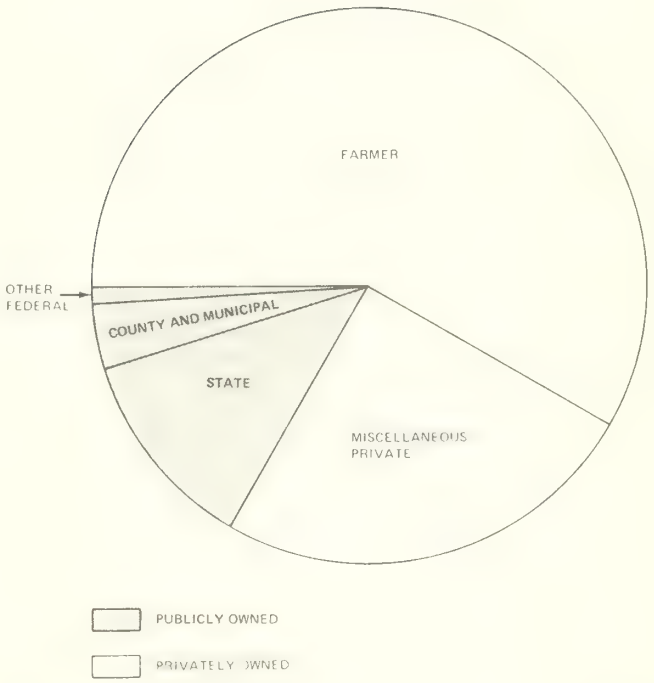


Figure 1.—*Distribution of commercial forest land by ownership class, Central Hardwood Unit, Minnesota, 1977.*

Timber Volume

- Even though commercial forest area declined between surveys, growing-stock volume spurted from 1.2 billion cubic feet in 1962 to 1.5 billion cubic feet in 1977 (a 31 percent gain) (fig. 2).

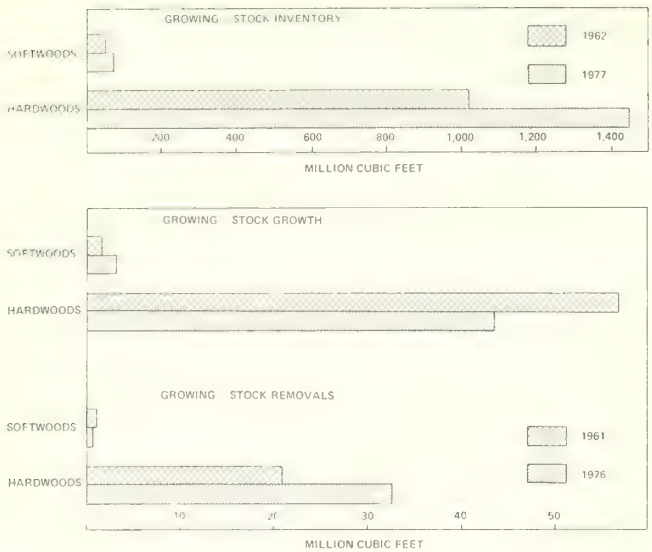


Figure 2.—*Growing-stock inventory, net annual growth and removals, by softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1962 to 1977.*

- Sawtimber volume increased from 2.6 billion board feet in 1962 to 4.6 billion board feet in 1977.
- Pine County contains the largest growing-stock volume—299 million cubic feet (19 percent of the Unit total).
- Select red oaks (327 million cubic feet) and aspen (284 million) account for the largest volumes of growing stock.
- Thirty-seven percent of the growing-stock volume is in stands aged 41 to 60 years.
- The average growing-stock volume per acre is 793 cubic feet (10.0 cords per acre).
- The volume of cull trees (rough, rotten, and short-log) is 220 million cubic feet; salvable dead trees total 13 million cubic feet.

Stand Conditions

- Net annual growth on growing-stock trees was 62 million cubic feet (788,500 million cords) in 1976, compared with 46 million cubic feet (581,000 million cords) in 1961.
- Net annual growth rate of growing stock was 4.0 percent of inventory. The softwood growth rate (4.7 percent) was higher than the hardwood rate (4.0 percent).
- Net growth averaged 31.9 cubic feet per acre in 1976, compared with 19.4 in 1961.
- Average annual mortality of growing-stock trees was 17 million cubic feet in 1976; half of it attributable to disease.
- The growing-stock mortality rate averaged 1.1 percent of inventory in 1976.
- Seventy percent of the commercial forest area is capable of growing trees 50 feet and taller at age 50, but only 14 percent is capable of growing trees 70 feet and taller at the same age.
- Forty-eight percent of the commercial forest is composed of stands 50 years of age or younger.

Timber Use

- Timber removals[2] from growing stock totaled 34 million cubic feet (432,900 cords) in 1976. Softwoods contributed 1 million cubic feet and hardwoods 33 million.
- Timber removals from growing stock in 1976 represented a 51 percent increase over removals in 1962 (23 million cubic feet).
- Pine County contributed 12 percent of the growing-stock removals (4.0 million cubic feet) and Mille Lacs County accounted for 10 percent (3.5 million cubic feet).
- Ninety-six percent of the growing-stock removals came from private, nonindustrial lands.
- Timber products output totaled 18.5 million cubic feet in 1975; 8.1 million cubic feet in fuelwood alone.
- Primary plant residue totaled 2.3 million cubic feet in 1975, including 0.3 million cubic feet that were not utilized.

TABLES

Area:

1. Area of land by land class, 1962 and 1977.
2. Area by land class and county.
3. Area of commercial forest land by county and ownership class.
4. Area of commercial forest land by county and forest type.
5. Area of commercial forest land by county and site index class.

[2]*Removals in 1976 are trend level removals. "Other" removals from transfer of commercial forest land to productive-reserved are not included in 1976 removals.*

6. Area of commercial forest land by county and stand-size class.
7. Area of commercial forest land by site and ownership class.
8. Area of commercial forest land by forest type and ownership class.
9. Area of commercial forest land by forest type and stand-age class.
10. Area of commercial forest land by forest type, stand-size, and site class.
11. Area of noncommercial forest land by ownership class.
12. Area of noncommercial forest land by forest type.

Number of Trees:

13. Number of all live trees on commercial forest land by species and diameter class.
14. Number of growing-stock trees on commercial forest land by species and diameter class.
15. Number of short-log trees on commercial forest land by species and diameter class.

Volume:

16. Net volume of growing stock and sawtimber on commercial forest land by species, 1962 and 1977.
17. Cubic foot volume in all live trees on commercial forest land by species and diameter class.
18. Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods.
19. Net volume of growing stock on commercial forest land by species and county.
20. Net volume of sawtimber on commercial forest land by species and county.
21. Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species.
22. Net volume of growing stock on commercial forest land by species and diameter class.
23. Net volume of sawtimber on commercial forest land by species and diameter class.
24. Net volume of growing stock on commercial forest land by species and forest type.
25. Net volume of sawtimber on commercial forest land by species and forest type.
26. Net volume of growing stock on commercial forest land by species and ownership class.
27. Net volume of sawtimber on commercial forest land by species and ownership class.
28. Net volume of growing stock on commercial forest land by forest type and stand-age class.
29. Net volume of sawtimber on commercial forest land by forest type and stand-age class.
30. Net volume of short-log trees on commercial forest land by species and diameter of class (in cubic feet).
31. Net volume of short-log trees on commercial forest land by species and diameter class (in board feet).

Growth:

32. Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, 1961 and 1976.
33. Net annual growth of growing stock on commercial forest land by species and county.
34. Net annual growth of sawtimber on commercial forest land by species and county.
35. Net annual growth of growing stock on commercial forest land by species and ownership class.
36. Net annual growth of sawtimber on commercial forest land by species and ownership class.
37. Net annual growth of growing stock on commercial forest land by species and forest type.
38. Net annual growth of sawtimber on commercial forest land by species and forest type.
39. Net annual growth of growing stock on commercial forest land by forest type and stand-age.
40. Net annual growth of sawtimber on commercial forest land by forest type and stand-age.

Timber removals:

41. Timber removals from growing stock and sawtimber on commercial forest land by species, 1960 and 1976.
42. Timber removals from growing stock on commercial forest land by species and county.
43. Timber removals from sawtimber on commercial forest land by species and county.
44. Timber removals from growing stock and sawtimber on commercial forest land by item and species group.

45. Timber removals from growing stock by ownership class and softwoods and hardwoods.
46. Timber removals from sawtimber by ownership class and softwood and hardwoods.

Mortality:

47. Annual mortality of growing stock on commercial forest land by species and cause.
48. Annual mortality of sawtimber on commercial forest land by species and cause.
49. Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods.

Utilization:

50. Output of timber products by source of material and softwoods and hardwoods.
51. Forest products harvested by ownership class and product.
52. Volume of primary plant residue by kind of material and type of use.
53. Timber products output from roundwood by species and product.

Text table:

54. Sampling errors for estimates smaller than State totals of volume, net growth, removals, and area of commercial forest land.

PRINCIPAL TREE SPECIES IN MINNESOTA'S CENTRAL HARDWOOD UNIT[3]

SOFTWOOD SPECIES:

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*
Black spruce ..... *Picea mariana*
White spruce ..... *Picea glauca*
Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*
Other softwoods:
Eastern redcedar ..... *Juniperus virginiana*

HARDWOOD SPECIES:

White oaks:
White oak ..... *Quercus alba*
Swamp white oak ..... *Quercus bicolor*
Bur oak ..... *Quercus macrocarpa*
Select red oaks:
Northern red oak ..... *Quercus rubra*
Other red oaks:
Northern pin oak ..... *Quercus ellipsoidalis*
Black oak ..... *Quercus velutina*
Hickories:
Butternut hickory ..... *Carya cordiformis*
Shagbark hickory ..... *Carya ovata*
Yellow birch ..... *Betula alleghaniensis*
Hard maples:
Sugar maple ..... *Acer saccharum*
Black maple ..... *Acer nigrum*
Soft maples:
Red maple ..... *Acer rubrum*
Silver maple ..... *Acer saccharinum*
Ashes:
White ash ..... *Fraxinus americana*
Black ash ..... *Fraxinus nigra*
Green ash ..... *Fraxinus pennsylvanica*
Balsam poplar ..... *Populus balsamifera*
Paper birch ..... *Betula papyrifera*
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*
Basswood ..... *Tilia americana*
Elms:
American elm ..... *Ulmus americana*
Slippery elm ..... *Ulmus rubra*
Rock elm ..... *Ulmus thomasii*
Select hardwoods:
Butternut ..... *Juglans cinerea*
Black walnut ..... *Juglans nigra*
Black cherry ..... *Prunus serotina*
Other hardwood:
Boxelder ..... *Acer negundo*
River birch ..... *Betula nigra*
Hackberry ..... *Celtisi occidentalis*
Kentucky coffeetree ..... *Gymnocladus dioicus*
Eastern cottonwood ..... *Populus deltoides*
Black willow ..... *Salix nigra*

[3] *The common and scientific names are based on: Little, Elbert L., Jr. 1953. Check list of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agric., Agric. Handb. 41, 472 p.*

APPENDIX

ACCURACY OF SURVEY

Resources Evaluation information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are only estimates. However, a measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in the Central Hardwood Unit in 1977, 1,951.1 thousand acres, has a sampling error of ± 1.45 percent (± 28.3 thousand acres). The chances are two out of three that the commercial forest area from a 100-percent inventory, then, would be expected to fall between 1,979.4 and 1,922.8 thousand acres (1,951.1 ± 28.3).

The following sampling errors are for total estimated volume, net growth, and removals for both growing stock and sawtimber, and for area of commercial forest land during the 1977 Central Hardwood Unit survey:

Item	Central Hardwood Unit totals	Sampling error (percent)
Growing stock:		
Volume	1.5 billion cubic feet	2.10
Growth	62.3 million cubic feet	3.02
Removals	34.2 million cubic feet	8.57
Sawtimber:		
Volume	4.5 billion board feet	3.01
Growth	205.9 million board feet	3.26
Removals	82.0 million board feet	7.70
Commercial forest land:	1.9 million acres	1.45

As survey data are broken down into units smaller than State or Survey Unit totals, the sampling error increases (table 54). The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit.

SURVEY PROCEDURE

The major steps in the survey of the Central Hardwood Unit were as follows:

1. A total of 65,328 1-acre points distributed systematically across aerial photos of the entire area, were observed. To make a preliminary estimate of forest area these points were classified as either forest land (12,819), unproductive forest land (36), nonforest land (52,332), or questionable (141). Next, all 12,819 of the forest points, 5 unproductive forest points, and all 141 of the questionable points were stereoclassified as to forest type, stand-size class, and density. Then 1,679 points classed as forest, 5 points classed as unproductive, 21 points classed as questionable, and 7,122 points classed as nonforest were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken. At each of the 1,362 commercial forest locations, 10 variable-radius plots (basal area factor 37.5) were established uniformly over the sample acre. Tree measurements made on these plots were the basis for estimates of timber volume, growth, mortality, number of trees, and other forest classifications.

2. Growth and mortality on all commercial forest land were estimated using the Forest Resources Evaluation Program (FREP)[4]; which is an individual tree-growth projection system that uses stand characteristics such as tree diameter to estimate tree volumes.

3. Statistics on timber utilization during 1975 were obtained from mill surveys. The Minnesota Department of Natural Resources and the North Central Forest Experiment Station canvassed resident sawmills, veneer mills, and other primary wood-using plants. The North Central Forest Experiment Station canvassed resident pulpmills as well as out-of-State sawmills, pulpmills, and veneer mills to

[4]*For more information on FREP, see: U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system for the Lake States Region. U.S. Department of Agriculture Forest Service, General Technical Report NC-49, 96 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.*

determine their use of timber from Minnesota. Fuelwood and fencepost output was based on a sample of private landowners to determine their production of fuelwood and fenceposts and on a canvass of industrial and public timber owners. Estimates of primary mill residue used for fuelwood were obtained from the canvass of Minnesota primary wood-using plants. Timber cut for products by ownership class was determined by a canvass of all public and industrial timber owners. The portion of timber cut unaccounted for by the latter owners was grouped under "farmer and other owners".

4. To develop wood utilization factors used in converting timber products output to timber removals for saw logs and pulpwood, 1,028 felled trees throughout the State were measured during 1975-1976. Factors for veneer logs were obtained during the 1967-1968 Wisconsin utilization study. Factors for all other products were obtained during the 1960-1961 Minnesota utilization study.

5. Field data were sent to St. Paul, Minnesota, for compilation.

COMPARING MINNESOTA'S FOURTH FOREST SURVEY WITH THE THIRD SURVEY

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier survey data so they are comparable to data from the new survey.

In Minnesota's Central Hardwood Unit, published 1962 commercial forest area was adjusted to take into account changes in the Unit boundaries between surveys and changes in survey methods. The result, an adjusted 1962 commercial forest area, appears in the tables presented in this report.

Original estimates of 1962 inventory, growth, mortality, and removals were based on the original, unadjusted 1962 commercial forest area. However, because the 1962 commercial forest area was adjusted to take into account changes in survey methods, the estimates of inventory, growth, mortality, and removals for the year must also reflect these changes.

A test was made to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes by means of Timber Resource Analysis System (TRAS), a Forest Service computer program for updating, backdating, and projecting timber volume, growth, mortality, and removals. In order for the program to work most effectively, the 2 years to be reconciled must have comparable commercial forest land bases so that changes in volumes between surveys reflect actual changes in forest conditions or land use. To achieve this condition it was necessary to make further adjustments in 1962 data so that land transferred from commercial forest to productive-reserved between the two surveys does not appear in the 1962 land base. If this adjustment were not made, removals between 1962 and 1977 would appear artificially high in order to absorb the loss of timber from this change in land status. This adjustment is made for the test only; area and volumes removed for the test are added back into the 1962 reported data.

TRAS recalculated 1962 volumes using 1977 estimates of cubic foot volume per tree and 1977 board foot-cubic foot ratios. This volume adjustment was necessary so that differences in volumes between surveys represent actual change and not merely change in the volume equations used on each occasion.

Removals estimates for 1962 and 1977 are for total removals, including timber cut in addition to "other" removals and are trend level removals. "Other" removals from transfer of commercial forest land to other land uses are not included. Published 1960 estimates are of timber cut only, and do not include "other" removals. TRAS generated an estimate of what "other" removals must have been in 1962 to provide the adjusted 1962 total removals.

When the final adjustments of 1962 data were completed, the resulting 1962 volumes and area were distributed among the four Survey Units. A check was made by hand to ensure that it was possible to move from the adjusted 1962 volumes to the new 1977 volumes in each Unit. This was done using the average periodic difference between growth and removals for the two surveys and applying this difference to the 1962 volume. Next, the same procedure was repeated for each individual species within each Unit to make certain inventory volumes reported for each species were consistent with reported growth and removals volumes.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares
1,000 board feet (International ¼-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters or 2.54 centimeters or 0.0254 meter.

DEFINITION OF TERMS

Land-Use Classes

Gross area.—The entire area of land and water as determined by the Bureau of Census, 1970.

Land area.—The area of dry land and land temporarily or partially covered by water such as marshes, swamps, floods plains, streams, sloughs, and estuaries. Canals less than ⅛-mile wide, and lakes, reservoirs, and ponds smaller than 40 acres are included as land area. These figures are from the Bureau of Census, 1970.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Includes afforested areas. The minimum forest area classified was 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas were classed as forest if less than 120 feet wide.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Noncommercial forest land.—(a) Unproductive—forest land incapable of yielding crops of industrial wood because of adverse site conditions, (b) Productive-reserved—forest land withdrawn from commercial timber use through statute or administrative regulation or exclusively used for Christmas tree production.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forested areas must be more than 1 acre in size, to qualify as nonforest land.

Ownership Classes

National forest.—Federal land that has been designated by executive order or statute as National Forests or purchase units, and other land under the administration of the USDA Forest Service.

Other Federal.—Federal land other than National Forest.

State, county, and municipal.—Land owned by States, counties, or local public agencies, or land leased by them for more than 50 years.

Forest industry.—Land owned by companies or individuals operating primary wood-using plants.

Farmer-owned.—Land owned by operators of farms. A farm must include 10 or more acres from which the sale of agricultural products totals $50 or more annualy, or if less than 10 acres, the yield must be at least $250 annually.

Farmer-owned, leased.—Land owned by an operator of a farm but leased to another party.

Miscellaneous private-corporation.—Land owned by a private corporation not in the business of operating primary wood-using plants.

Miscellaneous private-individual.—Land owned by a private individual.

Miscellaneous private-corporation, leased.—Land owned by a private corporation but leased to another party.

Miscellaneous private-individual, leased.—Land owned by a private individual but leased to another party.

Tree Classes

All live trees—Growing-stock, rough, and rotten trees 1 inch d.b.h. and larger.

Growing-stock trees.—All live trees of commercial species except rough and rotten trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, and of relatively high vigor and containing no pathogens that kill or seriously deteriorate them before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Acceptable trees.—Trees meeting the standards for growing stock but not qualifying as desirable trees.

Sawtimber trees.—Growing-stock trees of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches.

Poletimber trees.—Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size and of good form and vigor.

Saplings.—Live trees of commercial species 1.0 to 5.0 inches d.b.h. and of good form and vigor.

Seedlings.—Live trees of commercial species less than 1.0 inch d.b.h. that are expected to survive according to regional standards. (Examples of seedlings not expected to survive are those that are diseased or heavily damaged by logging, browsing, or fire.) Only softwood seedlings more than 6 inches and hardwood seedlings more than 1 foot tall are counted.

Rotten trees.—Live trees (any size) of commercial species that do not contain a merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of rot (that is, when more than 50 percent of the cull volume of the tree is rotten).

Rough trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness and poor form, as well as all live noncommercial species.

Short-log (rough trees).—Sawtimber-sized trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Stocking

The degree of utilization of land by trees as measured in terms of basal area and/or the number of trees in a stand compared to the basal area and/or number of trees required to fully utilize the growth potential of the land.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stocking of all live trees, growing-stock trees, and desirable trees are recorded separately and stands are grouped into the following stocking classes.

Stocking Classes

Overstocked stands.—Stands in which stocking of trees is 133 percent or more.

Fully-stocked stands.—Stands in which stocking of trees is from 100 to 133 percent.

Medium-stocked stands.—Stands in which stocking of trees is from 60 to 100 percent.

Poorly-stocked stands.—Stands in which stocking of trees is from 16.7 to 60 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Stand-Size Classes

Stand.—A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Sawtimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber or poletimbr trees and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands at least 16.7 percent stocked with growing-stock trees, and with half or more of this stocking in sawtimber and/or poletimber trees and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands at least 16.7 percent stocked with growing-stock trees and with saplings and/or seedlings comprising more than half of this stocking.

Nonstocked areas.—Commercial forest land on which stocking of growing-stock trees is less than 16.7 percent.

Other Classifications

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood expressed in cubic-foot growth per acre per year.

Stand-age.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all the trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Forest Types

A classification of forest land based upon the species forming a plurality of live-tree stocking. Major forest types in Minnesota are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple).

White pine.—Forests in which eastern white pine comprises a pluraity of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir comprises a plurality of stocking. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce comprises a plurality of the stocking. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, tamarack.)

Black spruce.—Forests in which swamp conifers (black spruce, tamarack, and northern white-cedar) comprise a plurality of the live-tree stocking, with black spruce the most common.

Northern white-cedar.—Forests in which swamp conifers comprise a plurality of live tree stocking, with northern white-cedar the most common.

Tamarack—Forests in which swamp conifers comprise a pluraity of live-tree stocking, with tamarack the most common.

Oak.—Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)

Elm-ash-cottonwood.—Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)

Maple-basswood.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Timber Volume

Volume of growing stock.—The volume of sound wood in the bole of growing-stock trees 5.0 inches d.b.h. and over, from a 1-foot stump to a minimum of 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Growing-stock volumes are shown in cubic feet. Conversion to cords may be accomplished by a factor of 79 cubic feet per solid wood cord.

Volume of sawtimber.—Net volume of saw log portion of live sawtimber trees in board feet, International ¼-inch rule, from stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Upper stem portion.—That part of the bole of sawtimber trees above the merchantable sawtimber top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Growth and Mortality

Net volume growth of growing stock.—Net annual growth of growing stock is the change in volume of sound wood that occurred during 1976 in growing-stock trees that were 5.0 inches d.b.h. or larger at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than 5.0 inches d.b.h. at the beginning of the year that grew sufficiently during the year to be reclassified into the 5.0-inch-or-larger d.b.h. classes (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year but were reclassified during the year as growing-stock trees,

plus

the annual change in volume of sound wood that occurred during the year on growing-stock trees that died during the year,

plus

the annual change in volume of sound wood that occurred in growing-stock trees included among timber removals for the year,

plus

the annual change in volume of sound wood in trees that had been classified as growing stock at the beginning of the year but were reclassified during the year as rotten or rough trees. Only the volume change that occurred during the portion of the year the trees were classified as growing stock was included,

minus

the volume of sound wood in growing-stock trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as growing stock at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Net annual growth of sawtimber.—Net annual growth of sawtimber is the change in volume of sound wood that occurred during 1976 in trees that were sawtimber size at the beginning of the year,

plus

the volume of sound wood in growing-stock trees smaller than sawtimber size at the beginning of the year that grew sufficiently during the year to be classified as sawtimber trees (ingrowth),

plus

the volume of sound wood in trees that had been classified either as rough or rotten trees at the beginning of the year, but were reclassified during the year as sawtimber trees,

plus

the annual change in volume of sound wood that occurred during the year on sawtimber trees that died during the year,

plus

the annual change in volume of sound wood that occurred in sawtimber trees included among timber removals for the year.

plus

The annual change in volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees. Only the volume change that occurred during the portion of the year the trees were classified as sawtimber was included,

minus

the volume of sound wood in trees that had been classified as sawtimber trees that died from natural causes during the year,

minus

the volume of sound wood in trees that had been classified as sawtimber trees at the beginning of the year, but were reclassified during the year as rough or rotten trees.

Mortality of growing stock.—The volume of sound wood in growing-stock trees dying annually from natural causes. Natural causes include fire, insects, disease, animal damage, weather, and suppression.

Mortality of sawtimber.—The net board-foot volume of sawtimber trees dying annually from natural causes.

Timber Removals

Timber removals from growing stock. —The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals. Roundwood products are logs, bolts,

or other round sections cut and used from trees. Logging residues are the unused portions of cut trees plus unused trees killed by logging. Other removals are growing-stock trees removed but not utilized for products or trees left standing but "removed" from the commercial forest land classification by land use change—examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Timber removals from sawtimber.—The net board-foot volume of live sawtimber trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output.—All timber products cut from roundwood, and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Plant byproducts.—Wood products, such as pulpwood chips, obtained incidental to production of other manufactured products.

Plant residues.—Wood materials from manufacturing plants not utilized for some product.

Table 1.—*Area of land by land class, Central Hardwood Unit, Minnesota, 1962 and 1977*
(In thousand acres)

Land class	[1]1962	1977
COMMERCIAL FOREST LAND:		
Jack pine	23.3	11.3
Red pine	14.1	10.6
White pine	6.6	7.0
Balsam fir	7.7	7.5
White spruce	2.9	—
Black spruce	20.7	17.9
Northern white-cedar	—	—
Tamarack	58.5	30.8
Oak-hickory	600.3	571.8
Elm-ash-cottonwood	414.0	129.5
Maple-basswood	327.8	485.8
Aspen	640.0	560.2
Paper birch	15.2	80.1
Balsam poplar	—	10.7
Nonstocked	229.2	27.9
Subtotal	2,360.3	1,951.1
NONCOMMERCIAL FOREST LAND:		
Unproductive	351.3	120.2
Productive-reserved	36.6	72.4
Subtotal	387.9	192.6
NONFOREST LAND:	9,215.3	9,775.5
TOTAL	11,963.5	11,919.2

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 areas because of changes in survey procedures and definitions.

Table 2.—*Area of land by land use class and county, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Land class	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur
FOREST LAND														
Commercial	1,951.1	36.6	26.1	10.4	50 2	16.5	18.5	65.3	56.4	7.8	111.5	46 9	129 0	10 0
Productive-reserved	72.4	1 4	0.3	0.7	1.0	0.9	0 9	2 6	0 9	2.7	1 0	1 9	0 6	0 4
Unproductive	120.2	4.9	1.9	1 2	4.5	2.1	1 0	5 0	3.4	0 9	7 1	5 3	4.9	1 0
Total forest	2,143.7	42 9	28.3	12.3	55.7	19.5	20 4	72.9	60.7	11.4	119.6	54.1	134.5	11.4
NONFOREST LAND														
Nonforest with trees:														
Cropland with trees	35 4	1 6	0 4	1 9	1.1	—	—	1 1	0 8	2 0	0 9	0 9	0 3	2 9
Improved pasture with trees	50 0	1 4	1 2	1 1	1 1	—	0 3	2 0	1 1	1 0	2 1	1 0	1 4	1 1
Wooded strips	99 4	3.6	2.3	3.6	2.4	0 3	0.2	3.9	2.1	3.5	3.2	2 0	2 0	4 8
Idle farmland with trees	3 9	0 2	0.3	—	0.2	—	0 1	0.1	0.1	—	0 1	0 3	0 1	—
Windbreaks	103.1	5.5	5.4	3.6	2.7	0 6	—	6.1	2.1	3 3	4.1	1 6	1.0	3.3
Wooded pasture	80.5	2 8	1.4	1.8	2 0	0.1	0.9	4 5	1.7	1.7	3.0	2.1	2 0	1.9
Total nonforest with trees	372.3	15.1	11.0	12.0	9.5	1 0	1.5	17.7	7.9	11.5	13.4	7 9	6.8	14.0
Nonforest without trees														
Cropland without trees	7,218.5	163.1	170.2	159.0	153.2	273.7	306 5	360.5	322.0	259.0	172 6	165 4	139.8	204.2
Improved pasture without trees	159.5	3.6	3.7	0.3	3.4	5.7	6 5	7.7	6.9	5.4	4 2	3 7	3.3	4 3
Idle farmland without trees	5 8	0.1	0.1	—	0.1	0 1	0.1	0.1	0.1	0 1	—	0.1	0.1	—
Marsh	662 5	16.6	14.1	11.9	15.3	19 6	22 9	26.8	23.7	18.5	13.5	17.2	20 4	15.0
Other farm-farmstead	219.0	5.0	5.2	4.8	4 6	8 2	9.2	11.1	9 8	7.8	5.4	5 0	4.2	6.1
Urban and other	1,085.7	23 8	24.6	26.4	25.7	40 6	43.3	53.0	50.6	48 8	32 3	26 1	24.4	25.3
Noncensus water	52.2	0.8	0.2	0.2	0 6	—	3.5	—	0.4	0 6	0 4	1.1	1 6	1.3
Total nonforest without trees	9,403.2	213.0	218.1	205 6	202 9	347 9	392 0	459.2	413.5	340.2	228 4	218 6	193 8	256.2
Total nonforest	9,775.5	228.1	229.1	217.6	212.4	348 9	393.5	476.9	421.4	351.7	241.8	226 5	200 6	270 2
Total land area[1]	11,919 2	271.0	257.4	229 9	268.1	368 4	413.9	549 8	482 1	363 1	361 4	280 6	335 1	281 6
Census water	581.9	12.5	3.1	9 5	16.1	7 9	48 8	—	11.3	26 6	3.1	8 0	4 1	17.3
Total gross area	12,501.1	283 5	260.5	239.4	284.2	376 3	462 7	549 8	493 4	389 7	364 5	288 6	339 2	298 9

[1]U.S. Department of Commerce, Bureau of Census. 1970. Area measurements reports, GE-20, 22 p.

(Table 2 continued on next page)

(Table 2 continued)

Land class	Mille Lacs	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Wash-ington	Winona	Wright
FOREST LAND:															
Commercial	122.8	148.7	32.0	186.3	425.6	—	12.1	13.6	56.9	56 0	104.5	57.4	10.2	106 3	33 5
Productive-reserve	8.7	1.1	0.1	8.6	29 8	0.1	1.2	1 2	0.6	0.1	0.7	0 6	0 9	2.7	0.7
Unproductive	4.7	11.5	3.2	5 6	22.2	—	0.8	1.5	4 8	4.2	5.9	4.1	1 0	5 9	1.6
Total forest	136.2	161.3	35.3	200.5	477.6	0.1	14.1	16.3	62.3	60.3	111.1	62.1	12.1	114 9	35 8
NONFOREST LAND:															
Nonforest with trees:															
Cropland with trees	0.6	2.6	0.4	3.7	0.5	—	3.0	2.0	1.0	4 4	0.7	0.3	0 6	0 6	1.1
Improved pasture with trees	2.2	2.8	0.9	9.9	2.6	—	2.2	0.9	2.7	4.8	1.5	1.0	0 3	2 0	1 4
Wooded strips	3.2	6.1	1.6	13.6	6.7	—	5.5	3.5	3 9	11.4	2.1	1.5	1 0	2 7	2.7
Idle farmland with trees	0.1	0 6	0.1	0.3	0.3	—	—	—	0.3	0.1	0.3	0.1	—	0.2	—
Windbreaks	1 3	5.7	2.6	9.1	3.1	—	4.9	2.8	6 7	16.5	1.3	2.1	0 6	4 0	3.1
Wooded pasture	2.6	7.3	2.1	10.7	4.9	—	3.0	1.7	3.2	7.3	3.5	2.4	0.5	3.0	2.4
Total nonforest with trees	10.0	25.1	7.7	47.3	18.1	—	18.6	10.9	17.8	44.5	9.4	7 4	3.0	12.5	10 7
Nonforest without trees															
Cropland without trees	158.5	412.4	296.5	771.1	261.8	81.3	222.9	151.3	149.8	599 7	370.2	203.1	184 1	207 6	299 0
Improved pasture without trees	3.6	9.2	6.3	16.9	8.0	1 7	4.7	3 2	3.4	12.8	8.4	4 4	3 9	4.9	6 4
Idle farmland without trees	0.1	0 2	0.1	0.4	3.2	—	—	—	0.1	0.1	0 4	0.1	—	—	0.1
Marsh	22 1	40.7	22 1	75.1	63.4	5 6	16.1	11.6	15.5	46 2	40.0	16.3	13.4	15.8	23.1
Other farm-farmstead	4.8	12.7	9.1	23.2	7.8	2.4	6.7	4 6	4 7	18.2	11.2	6.3	5 5	6 4	9.0
Urban and other	28.5	57.7	42.3	98.2	60.8	7.9	33 7	26 5	21.5	74.6	51.7	34 4	22.6	34 8	45 6
Noncensus water	1 8	2.1	0.2	23.5	4.0	—	0 8	1.3	0.7	2.5	0.2	—	2.3	0 2	1 9
Total nonforest without trees	219.4	535.0	376.6	1,008 4	409.0	98.9	284 9	198.5	195.7	754.1	482.1	264 6	231.8	269 7	385.1
Total nonforest	229.4	560.1	384.3	1,055.7	427.1	98.9	303.5	209 4	213.5	798 6	491.5	272.0	234.8	282.2	395.8
Total land area[1]	365.6	721.4	419.6	1,256 2	904 7	99 0	317 6	225.7	275.8	858.9	602.6	334.1	246 9	397.1	431.6
Census water	66 4	19.1	0.2	160.4	8.6	10.4	9.4	7.3	10.3	33 3	24.6	8.3	21.2	7 4	26.7
Total gross area	432 0	740 5	419 8	1,416.6	913.3	109 4	327 0	233 0	286.1	892 2	627.2	342.4	268 1	404.5	458.3

Table 3.— *Area of commercial forest land by county and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
Anoka	36.6	—	—	—	1.0	3.6	0.5	—	24.7	—	1.2	5.6	—	—
Benton	26.1	—	—	—	0.2	2.7	0.7	—	17.9	—	1.1	3.5	—	—
Carver	10.4	—	—	—	0.6	0.8	0.2	—	6.9	—	0.5	1.4	—	—
Chisago	50.2	—	—	—	1.4	5.3	1.0	—	31.2	—	1.7	9.5	—	0.1
Dakota	16.5	—	—	—	0.6	1.4	0.4	—	10.0	—	0.7	3.4	—	—
Douglas	18.5	—	—	—	—	2.2	0.4	—	11.6	—	0.3	3.9	—	0.1
Fillmore	65.3	—	—	—	0.4	7.6	0.4	—	47.8	—	1.2	7.9	—	—
Goodhue	56.4	—	—	—	1.0	5.4	0.5	—	41.5	—	1.4	6.5	—	0.1
Hennepin	7.8	—	—	—	0.5	0.7	0.2	—	4.7	—	0.4	1.3	—	—
Houston	111.5	—	—	—	1.4	9.0	0.8	—	89.9	—	2.6	7.8	—	—
Isanti	46.9	—	—	—	0.5	5.5	0.7	—	28.8	—	1.3	10.1	—	—
Kanabec	129.0	—	—	0.5	1.3	16.7	5.9	—	64.7	—	4.9	34.9	—	0.1
Le Sueur	10.0	—	—	—	0.8	0.8	0.2	—	5.8	—	0.6	1.8	—	—
Mille Lacs	122.8	—	—	0.5	0.9	15.8	5.4	—	62.7	—	4.3	33.0	—	0.2
Morrison	148.7	—	—	0.1	1.3	17.7	1.9	—	99.9	—	3.5	24.3	—	—
Olmsted	32.0	—	—	—	0.2	3.3	0.2	—	24.0	—	0.6	3.7	—	—
Otter Tail	186.3	—	—	0.8	0.5	24.7	8.2	—	94.1	—	5.8	51.8	—	0.4
Pine	425.6	—	—	2.2	1.6	74.2	25.0	0.5	158.9	—	17.4	145.4	—	0.4
Ramsey	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rice	12.1	—	—	—	0.9	1.0	0.3	—	7.1	—	0.7	2.1	—	—
Scott	13.6	—	—	—	1.0	1.0	0.2	—	8.7	—	0.7	2.0	—	—
Sherburne	56.9	—	—	—	0.4	6.7	0.4	—	42.1	—	1.0	6.3	—	—
Stearns	56.0	—	—	—	0.6	4.3	0.8	—	43.6	—	1.8	4.9	—	—
Todd	104.5	—	—	0.3	0.7	13.2	2.6	—	61.6	—	2.5	23.4	—	0.2
Wabasha	57.4	—	—	—	0.5	6.5	0.5	—	41.5	—	1.2	7.2	—	—
Washington	10.2	—	—	—	0.7	1.0	0.3	—	5.5	—	0.6	2.1	—	—
Winona	106.3	—	—	—	1.0	9.7	0.7	—	84.3	—	2.3	8.3	—	—
Wright	33.5	—	—	—	0.3	3.9	0.6	—	21.9	—	0.8	6.0	—	—
All counties	1,951.1	—	—	4.4	20.3	244.7	59.0	0.5	1,141.4	—	61.1	418.1	—	1.6

Table 4.— *Area of commercial forest land by county and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
Anoka	36.6	0.3	0.3	0.1	0.1	—	—	—	0.7	11.7	4.0	11.7	5.8	0.9	0.1	0.9
Benton	26.1	0.7	0.7	0.1	—	—	—	—	0.1	9.5	1.7	7.4	4.9	0.7	0.1	0.2
Carver	10.4	—	—	0.1	—	—	—	—	0.1	3.4	1.3	4.0	1.1	0.2	—	0.2
Chisago	50.2	0.8	0.7	0.1	0.1	—	0.5	—	1.4	12.5	5.0	17.3	9.1	1.2	0.3	1.2
Dakota	16.5	—	0.2	—	—	—	—	—	0.5	3.7	2.7	5.3	3.0	0.6	—	0.5
Douglas	18.5	—	—	0.1	—	—	—	—	0.3	4.4	1.3	5.4	5.7	0.6	0.2	0.5
Fillmore	65.3	0.4	0.1	0.2	—	—	—	—	0.2	33.5	3.0	13.7	11.0	2.3	0.3	0.6
Goodhue	56.4	0.3	0.2	0.1	—	—	—	—	0.2	29.5	3.0	13.8	6.6	2.0	0.2	0.5
Hennepin	7.8	—	—	—	—	—	—	—	0.2	1.7	1.1	3.3	1.0	0.1	0.2	0.2
Houston	111.5	0.2	0.1	0.2	—	—	—	—	0.1	66.6	3.9	28.1	8.1	3.3	0.6	0.3
Isanti	46.9	1.3	1.3	0.1	0.1	—	0.8	—	2.0	11.1	4.2	12.7	10.5	1.3	0.3	1.2
Kanabec	129.0	0.1	0.4	0.2	0.2	—	0.9	—	2.9	27.0	9.8	29.4	49.4	6.5	0.5	1.7
Le Sueur	10.0	—	—	—	—	—	—	—	0.3	2.0	1.7	4.2	1.3	0.2	—	0.3
Mille Lacs	122.8	0.1	0.5	0.4	0.2	—	0.8	—	2.6	22.7	9.1	34.2	43.9	5.8	0.6	1.9
Morrison	148.7	1.1	0.9	0.3	—	—	0.4	—	2.4	57.0	9.9	35.9	32.6	5.1	0.8	2.3
Olmsted	32.0	0.1	0.1	0.1	—	—	—	—	0.2	16.1	1.7	7.2	5.1	1.0	0.1	0.3
Otter Tail	186.3	0.5	0.8	1.5	0.4	—	1.4	—	3.5	31.4	12.3	50.0	70.2	9.3	1.6	3.4
Pine	425.6	3.6	2.4	1.5	5.8	—	13.0	—	9.9	37.2	26.6	77.9	214.6	25.1	2.4	5.6
Ramsey	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rice	12.1	—	—	—	—	—	—	—	0.1	2.3	1.6	5.7	1.8	0.2	0.1	0.3
Scott	13.6	—	—	—	—	—	—	—	0.2	3.9	2.0	5.6	1.4	0.2	—	0.3
Sherburne	56.9	0.9	1.3	1.1	0.3	—	—	—	0.2	28.5	2.8	12.6	6.7	1.7	0.3	0.5
Stearns	56.0	0.1	0.1	0.2	—	—	—	—	0.4	26.6	3.7	16.1	6.8	1.4	0.3	0.3
Todd	104.5	0.1	0.2	0.3	0.3	—	—	—	1.3	23.8	7.5	32.7	31.6	3.4	0.6	2.7
Wabasha	57.4	0.3	0.2	0.1	—	—	—	—	0.4	28.6	2.9	12.8	9.2	2.1	0.2	0.6
Washington	10.2	—	—	—	—	—	0.1	—	0.3	1.5	1.6	4.4	1.7	0.3	—	0.3
Winona	106.3	0.3	0.1	0.1	—	—	—	—	—	63.8	3.2	25.0	9.3	3.5	0.5	0.5
Wright	33.5	0.1	—	0.1	—	—	—	—	0.3	11.8	1.9	9.4	7.8	1.1	0.4	0.6
All counties	1,951.1	11.3	10.6	7.0	7.5	—	17.9	—	30.8	571.8	129.5	485.8	560.2	80.1	10.7	27.9

Table 5.— *Area of commercial forest land by county and site index class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All classes	91+	81-90	71-80	61-70	51-60	41-50	31-40	21-30	11-20
Anoka	36.6	—	0.9	3.8	9.1	10.5	8.4	3.5	0.4	—
Benton	26.1	0.1	0.5	3.4	6.3	7.7	5.5	2.5	0.1	—
Carver	10.4	—	0.5	1.1	2.5	3.0	2.3	1.0	—	—
Chisago	50.2	—	1.4	5.9	11.7	14.9	11.2	4.8	0.3	—
Dakota	16.5	—	0.5	1.5	4.8	4.8	3.7	1.0	0.2	—
Douglas	18.5	—	0.3	1.7	4.7	5.3	4.7	1.7	0.1	—
Fillmore	65.3	0.1	1.5	7.3	15.9	16.1	16.3	7.8	0.3	—
Goodhue	56.4	0.2	1.6	6.2	13.4	15.7	13.5	5.7	0.1	—
Hennepin	7.8	—	0.3	1.1	1.9	2.3	1.6	0.6	—	—
Houston	111.5	0.6	3.0	11.0	25.5	33.3	26.7	11.3	0.1	—
Isanti	46.9	—	1.0	5.2	10.7	13.3	11.4	4.9	0.4	—
Kanabec	129.0	0.1	2.6	16.8	37.3	36.9	25.2	9.6	0.5	—
Le Sueur	10.0	—	0.6	1.1	2.4	3.0	2.1	0.7	0.1	—
Mille Lacs	122.8	—	2.2	15.7	34.6	35.3	25.5	8.9	0.6	—
Morrison	148.7	0.3	3.4	16.1	37.0	39.4	36.3	15.3	0.9	—
Olmsted	32.0	0.1	0.6	3.5	7.8	8.1	8.0	3.8	0.1	—
Otter Tail	186.3	—	2.8	23.3	51.6	54.7	39.4	13.5	1.0	—
Pine	425.6	—	6.2	60.8	126.5	131.9	65.9	30.9	3.4	—
Ramsey	—	—	—	—	—	—	—	—	—	—
Rice	12.1	—	0.6	1.4	2.8	3.8	2.5	1.0	—	—
Scott	13.6	—	0.7	1.5	3.2	4.1	2.9	1.1	0.1	—
Sherburne	56.9	0.2	1.1	6.1	13.6	16.0	14.0	5.7	0.2	—
Stearns	56.0	0.2	1.2	6.3	12.9	16.6	12.5	6.1	0.2	—
Todd	104.5	—	1.9	11.3	27.8	30.6	24.4	7.9	0.6	—
Wabasha	57.4	0.3	1.3	6.3	14.0	14.8	14.1	6.3	0.3	—
Washington	10.2	—	0.4	1.2	2.7	3.2	2.0	0.6	0.1	—
Winona	106.3	0.6	2.8	10.8	24.5	30.7	25.8	11.0	0.1	—
Wright	33.5	—	0.7	3.7	8.3	9.1	8.3	3.3	0.1	—
All counties	1,951.1	2.8	40.6	234.1	513.5	565.1	414.2	170.5	10.3	—

Table 6.— *Area of commercial forest land by county and stand-size class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

County	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Anoka	36.6	19.5	10.6	5.6	0.9
Benton	26.1	13.1	8.3	4.5	0.2
Carver	10.4	6.6	2.4	1.2	0.2
Chisago	50.2	24.1	17.1	7.9	1.1
Dakota	16.5	7.5	6.7	1.8	0.5
Douglas	18.5	6.5	8.0	3.5	0.5
Fillmore	65.3	35.4	22.5	6.8	0.6
Goodhue	56.4	32.2	18.6	5.1	0.5
Hennepin	7.8	4.6	1.9	0.9	0.4
Houston	111.5	71.7	29.7	9.7	0.4
Isanti	46.9	17.8	18.7	9.2	1.2
Kanabec	129.0	41.2	68.8	17.3	1.7
Le Sueur	10.0	5.8	2.9	1.0	0.3
Mille Lacs	122.8	39.1	64.6	17.2	1.9
Morrison	148.7	68.9	55.9	21.6	2.3
Olmsted	32.0	18.0	10.0	3.7	0.3
Otter Tail	186.3	53.3	101.0	28.6	3.4
Pine	425.6	84.9	246.1	89.0	5.6
Ramsey	—	—	—	—	—
Rice	12.1	7.2	3.3	1.3	0.3
Scott	13.6	8.6	3.2	1.4	0.4
Sherburne	56.9	31.2	17.0	8.4	0.3
Stearns	56.0	33.6	15.5	6.6	0.3
Todd	104.5	37.7	47.1	17.1	2.6
Wabasha	57.4	30.7	19.9	6.0	0.8
Washington	10.2	5.6	3.2	1.2	0.2
Winona	106.3	66.0	30.8	9.1	0.4
Wright	33.5	14.7	14.0	4.2	0.6
All counties	1,951.1	785.5	847.8	289.9	27.9

Table 7.— *Area of commercial forest land by site and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Owner	All classes	Site class (cubic feet of growth/acre/year)					
		225+	165-225	120-165	85-120	50-85	20-50
National forest	—	—	—	—	—	—	—
Bureau of Land Mgmt.	—	—	—	—	—	—	—
Indian	4.4	—	—	—	—	2.8	1.6
Miscellaneous federal	20.3	—	—	—	1.4	11.9	7.0
State	244.7	—	—	2.8	34.9	88.6	118.4
County and municipal	59.0	—	—	—	7.1	28.3	23.6
Forest industry	0.5	—	—	—	—	0.5	—
Farmer	1,141.4	—	1.4	1.6	82.9	436.7	618.8
Farmer owned-leased	—	—	—	—	—	—	—
Misc. private-corp.	61.1	—	—	—	9.3	24.5	27.3
Misc. private-individual	418.1	—	—	1.9	47.7	197.4	171.1
Misc. priv.-corp., leased	—	—	—	—	—	—	—
Misc. priv.-ind., leased	1.6	—	—	—	—	—	1.6
All owners	1,951.1	—	1.4	6.3	183.3	790.7	969.4

Table 8.— *Area of commercial forest land by forest type and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Owner	All types	Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
National forest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bureau of Land Mgmt.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Indian	4.4	—	—	—	—	—	—	—	—	1.4	—	3.0	—	—	—	—
Miscellaneous federal	20.3	—	—	—	—	—	—	—	—	2.5	13.5	3.0	1.3	—	—	—
State	244.7	3.2	1.9	—	3.5	—	5.1	—	4.7	46.4	19.1	35.4	113.2	11.7	—	0.5
County and municipal	59.0	—	—	—	—	—	—	—	—	6.4	4.3	16.5	26.4	5.4	—	—
Forest industry	0.5	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Farmer	1,141.4	3.6	4.8	5.1	2.3	—	1.7	—	17.7	428.9	54.4	337.9	216.5	36.2	10.7	21.6
Farmer owned-leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private-corp.	61.1	—	0.8	—	—	— 0.8	—	1.4	16.4	5.8	11.2	20.1	3.0	—	1.6	—
Misc. private-individual	418.1	4.0	3.1	1.9	1.7	—	10.3	—	7.0	69.8	32.4	77.2	182.7	23.8	—	4.2
Misc. private corp., leased	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Misc. private ind., leased	1.6	—	—	—	—	—	—	—	—	—	—	1.6	—	—	—	—
All owners	1,951.1	11.3	10.6	7.0	7.5	—	17.9	—	30.8	571.8	129.5	485.8	560.2	80.1	10.7	27.9

Table 9.— *Area of commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	140+
Jackpine	11.3	—	—	2.6	3.8	3.2	—	1.7	—	—	—	—	—	—
Red pine	10.6	—	1.9	5.8	—	1.3	—	—	—	1.6	—	—	—	—
White pine	7.0	—	1.9	—	—	—	1.4	3.0	0.7	—	—	—	—	—
Balsam fir	7.5	—	2.0	—	—	4.2	1.3	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	30.8	—	4.4	2.2	0.8	7.0	4.7	2.8	1.4	2.7	1.6	1.6	1.6	—
Oak-hickory	571.8	9.0	21.4	5.5	34.4	75.5	78.5	100.3	65.0	66.2	68.6	39.8	7.6	—
Elm-ash-cottonwood	129.5	10.1	12.7	7.3	4.7	17.9	23.6	19.5	15.6	4.5	10.6	1.6	1.4	—
Maple-basswood	485.8	18.3	18.3	15.5	39.7	60.8	70.8	91.5	69.7	46.9	24.7	26.5	3.1	—
Aspen	560.2	82.7	48.2	39.1	124.8	146.5	81.7	25.5	7.9	3.8	—	—	—	—
Paper birch	80.1	1.3	6.9	5.4	17.0	20.1	13.6	4.5	5.4	4.5	—	1.4	—	—
Balsam poplar	10.7	1.4	1.4	—	—	3.2	3.2	—	—	1.5	—	—	—	—
Nonstocked	27.9	20.8	2.4	1.6	—	1.7	—	—	1.4	—	—	—	—	—
All types	1,951.1	143.6	123.2	92.9	226.0	343.0	283.1	250.4	167.1	131.7	105.5	70.9	13.7	—

Table 10.— *Area of commercial forest land by forest type, stand-size class, and site class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Forest type and stand-size class	All site classes	Site class (cubic feet)				
		165 or more	120-165	85-120	50-85	Less than 50
Jack pine						
Sawtimber	3.1	—	—	1.4	1.7	—
Poletimber	6.3	—	—	0.7	2.4	3.2
Sapling & seedling	1.9	—	—	—	—	1.9
All stands	11.3	—	—	2.1	4.1	5.1
Red pine						
Sawtimber	1.6	—	—	—	1.6	—
Poletimber	6.3	—	1.9	3.1	6.3	—
Sapling & seedling	2.7	—	—	0.8	1.9	—
All stands	10.6	—	1.9	3.9	4.8	—
White pine						
Sawtimber	5.1	1.4	1.6	2.1	—	—
Poletimber	—	—	—	—	—	—
Sapling & seedling	1.9	—	—	1.9	—	—
All stands	7.0	1.4	1.6	4.0	—	—
Balsam fir						
Sawtimber	2.3	—	—	2.3	—	—
Poletimber	3.2	—	—	3.2	—	—
Sapling & seedling	2.0	—	—	—	—	2.0
All stands	7.5	—	—	5.5	—	2.0
White spruce						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling & seedling	—	—	—	—	—	—
All stands	—	—	—	—	—	—
Black spruce						
Sawtimber	—	—	—	—	—	—
Poletimber	5.1	—	—	—	—	5.1
Sapling & seedling	12.8	—	—	—	—	12.8
All stands	17.9	—	—	—	—	17.9
Northern white-cedar						
Sawtimber	—	—	—	—	—	—
Poletimber	—	—	—	—	—	—
Sapling & seedling	—	—	—	—	—	—
All stands	—	—	—	—	—	—

(Table 10 continued on next page)

(Table 10 continued)

Forest type and stand-size class	All site classes	Site class (cubic feet)				
		165 or more	120-165	85-120	50-85	Less than 50
Tamarack						
Sawtimber	7.6	—	—	—	3.1	4.5
Poletimber	14.5	—	—	2.0	1.5	11.0
Sapling & seedling	8.7	—	—	—	2.8	5.9
All stands	30.8	—	—	2.0	7.4	21.4
Oak-hickory						
Sawtimber	343.2	—	2.8	7.2	112.6	220.6
Poletimber	194.0	—	—	7.8	69.3	116.9
Sapling & seedling	34.6	—	—	—	10.1	24.5
All stands	571.8	—	2.8	15.0	192.0	362.0
Elm-ash-cottonwood						
Sawtimber	39.1	—	—	4.8	17.0	17.3
Poletimber	62.7	—	—	—	7.4	55.3
Sapling & seedling	27.7	—	—	—	3.2	24.5
All stands	129.5	—	—	4.8	27.6	97.1
Maple-basswood						
Sawtimber	296.7	—	—	17.9	115.1	163.7
Poletimber	147.4	—	—	7.6	42.3	97.5
Sapling & seedling	41.7	—	—	—	9.6	32.1
All stands	485.8	—	—	25.5	167.0	293.3
Aspen						
Sawtimber	70.1	—	—	13.1	49.7	7.3
Poletimber	349.1	—	—	80.9	219.9	48.3
Sapling & seedling	141.0	—	—	25.0	82.4	33.6
All stands	560.2	—	—	119.0	352.0	89.2
Paper birch						
Sawtimber	16.7	—	—	—	3.9	12.8
Poletimber	51.1	—	—	—	22.4	28.7
Sapling & seedling	12.3	—	—	—	12.3	
All stands	80.1	—	—	—	26.3	53.8
Balsam poplar						
Sawtimber	—	—	—	—	—	—
Poletimber	8.1	—	—	1.5	3.4	3.2
Sapling & seedling	2.6	—	—	—	1.3	1.3
All stands	10.7	—	—	1.5	4.7	4.5
Nonstocked	27.9	—	—	—	4.8	23.1
All types	1,951.1	1.4	6.3	183.3	790.7	969.4

Table 11.— *Area of noncommercial forest land by ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Ownership class	All areas	Productive-reserved areas	Unproductive areas
National Forest	—	—	—
Other federal	3.0	0.1	2.9
State, county and municipal	90.0	67.2	22.8
Forest industry	—	—	—
Farmer	78.8	—	78.8
Miscellaneous private	20.8	5.1	15.7
All ownerships	192.6	72.4	120.2

Table 12.— *Area of noncommercial forest land by forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Jack pine	3.5	3.5	—
Red-white pine	7.7	6.0	1.7
Spruce-fir	4.2	0.5	3.7
Black spruce	6.6	—	6.6
Northern white-cedar	—	—	—
Tamarack	3.0	—	3.0
Oak-hickory	81.6	8 .6	73.0
Elm-ash-cottonwood	41.9	22.1	19.8
Maple-basswood	8.0	8.0	—
Aspen-birch	36.1	23.7	12.4
Nonstocked	—	—	—
All forest types	192.6	72.4	120.2

Table 13.— *Number of all live trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height)													
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
White pine	4,037	2,531	601	205	202	145	75	74	92	43	37	15	15	2	—
Red pine	8,601	2,513	3,162	2,245	348	110	54	54	45	31	23	11	5	—	—
Jack pine	5,861	1,058	2,555	1,076	651	401	84	24	12	—	—	—	—	—	—
White spruce	807	546	50	101	34	32	19	3	15	—	2	1	4	—	—
Black spruce	10,814	5,211	3,734	1,596	245	12	—	16	—	—	—	—	—	—	—
Balsam fir	6,932	2,753	2,443	1,012	534	122	60	6	—	2	—	—	—	—	—
Tamarack	11,533	3,033	2,922	2,738	1,907	615	199	89	25	3	2	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	5,629	3,011	1,449	686	341	65	50	11	8	4	3	1	—	—	—
Total	54,214	20,656	16,916	9,659	4,262	1,502	541	277	197	83	67	28	24	2	—
HARDWOODS:															
Select white oaks	51,597	13,826	10,258	8,185	6,576	4,907	3,131	1,982	1,308	592	362	196	238	34	2
Select red oaks	46,569	6,418	5,555	8,085	7,712	6,359	4,516	3,167	2,065	1,259	652	375	353	51	2
Other red oaks	758	—	—	120	116	91	85	108	89	58	41	24	25	1	—
Hickory	14,559	9,663	1,967	1,534	594	404	203	125	48	12	7	2	—	—	—
Yellow birch	1,218	884	200	43	17	19	29	19	—	4	3	—	—	—	—
Hard maple	48,775	29,598	8,909	4,241	2,077	1,544	1,012	587	341	239	117	42	64	3	1
Soft maple	54,607	29,106	16,355	5,368	2,047	678	360	255	177	102	52	31	49	20	7
Ash	62,178	28,741	13,225	9,854	5,658	2,485	1,192	578	247	115	39	21	15	6	2
Balsam poplar	5,070	1,605	928	976	842	468	157	41	27	12	12	—	2	—	—
Paper birch	66,911	24,232	19,068	12,738	7,289	2,559	695	194	114	20	—	2	—	—	—
Bigtooth aspen	7,186	1,467	902	1,419	1,554	985	547	193	72	38	5	4	—	—	—
Quaking aspen	156,878	66,127	34,673	23,414	16,488	9,413	4,479	1,563	532	129	53	2	5	—	—
Basswood	59,893	30,148	11,923	6,458	4,213	2,497	1,883	1,142	707	387	251	122	138	22	2
Elm	77,742	37,835	16,510	8,620	5,537	3,276	2,093	1,226	960	652	344	247	341	86	15
Select hardwoods	15,263	9,275	2,136	1,698	676	590	425	212	157	59	18	4	8	5	—
Other hardwoods	22,461	11,730	4,418	2,449	1,442	987	639	273	222	116	55	48	44	29	9
Noncommercial species	69,600	50,590	14,615	3,224	873	169	66	40	14	3	3	—	1	2	—
Total	761,265	351,245	161,642	98,426	63,711	37,431	21,512	11,705	7,080	3,797	2,014	1,120	1,283	259	40
All species	815,479	371,901	178,558	108,085	67,973	38,933	22,053	11,982	7,277	3,880	2,081	1,148	1,307	261	40

Table 14.— *Number of growing-stock trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height)													
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:															
White pine	2,329	1,157	444	162	125	132	69	69	84	40	37	15	15	—	—
Red pine	8,123	2,237	3,004	2,245	326	100	54	50	45	28	23	7	4	—	—
Jack pine	4,972	549	2,380	933	623	388	77	15	7	—	—	—	—	—	—
White spruce	798	547	50	101	34	22	19	3	15	—	2	1	4	—	—
Black spruce	8,811	3,731	3,328	1,505	231	—	—	16	—	—	—	—	—	—	—
Balsam fir	5,269	1,755	1,872	977	506	97	60	2	—	—	—	—	—	—	—
Tamarack	10,065	2,248	2,767	2,456	1,746	587	162	78	21	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,484	2,697	851	517	321	48	42	4	4	—	—	—	—	—	—
Total	44,851	14,901	14,696	8,896	3,912	1,374	483	237	176	68	62	23	23	—	—
HARDWOODS:															
Select white oaks	36,550	7,815	6,953	6,326	5,334	4,214	2,382	1,655	939	409	252	124	128	17	2
Select red oaks	39,823	5,132	4,543	6,932	6,859	5,676	3,980	2,806	1,743	1,057	512	307	244	31	1
Other red oaks	638	—	—	90	99	80	80	81	90	52	26	15	24	1	—
Hickory	12,111	7,906	1,533	1,379	561	387	189	101	36	12	5	2	—	—	—
Yellow birch	1,097	886	200	—	—	—	11	—	—	—	—	—	—	—	—
Hard maple	36,150	20,727	7,662	3,328	1,576	1,137	730	430	246	179	71	26	37	—	1
Soft maple	40,251	20,301	12,675	4,465	1,581	462	265	188	127	74	30	22	41	15	5
Ash	50,525	21,574	11,422	8,574	4,920	2,179	981	496	210	101	29	18	15	4	2
Balsam poplar	3,916	1,447	480	705	668	416	128	27	24	9	12	—	—	—	—
Paper birch	53,304	16,565	15,629	11,463	6,584	2,290	557	124	80	10	—	2	—	—	—
Bigtooth aspen	5,692	1,033	741	988	1,437	857	442	123	42	22	3	4	—	—	—
Quaking aspen	110,801	46,589	22,304	17,213	12,838	7,190	3,341	979	272	48	21	2	4	—	—
Basswood	44,692	20,250	8,901	5,634	3,693	2,275	1,614	947	617	339	220	95	92	14	1
Elm	58,588	27,129	11,978	7,329	4,626	2,809	1,696	961	764	516	267	189	254	60	10
Select hardwoods	10,271	6,474	1,315	1,150	405	401	251	110	116	36	8	2	3	—	—
Other hardwoods	13,667	7,104	2,804	1,667	777	577	287	120	140	78	33	27	23	21	9
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	518,076	210,932	109,140	77,243	51,958	30,950	16,934	9,148	5,446	2,942	1,489	835	865	163	31
All species	562,927	225,833	123,836	86,139	55,870	32,324	17,417	9,385	5,622	3,010	1,551	858	888	163	31

Table 15.—*Number of short-log trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand trees)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	1	—	—	—	—	—	—	—	—	1	—
Red pine	9	9	—	—	—	—	—	—	—	—	—
Jack pine	21	14	7	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	12	12	—	—	—	—	—	—	—	—	—
Tamarack	7	—	7	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	17	17	—	—	—	—	—	—	—	—	—
Total	67	52	14	—	—	—	—	—	—	1	—
HARDWOODS:											
Select white oaks	709	—	326	92	138	66	34	26	21	6	—
Select red oaks	479	—	134	140	75	59	23	27	19	2	—
Other red oaks	25	—	5	12	—	3	3	2	—	—	—
Hickory	17	—	5	10	—	—	2	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—
Hard maple	169	—	51	47	30	15	19	—	6	1	—
Soft maple	25	—	—	11	8	4	—	—	—	1	1
Ash	79	—	45	21	8	3	2	—	—	—	—
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—
Paper birch	58	—	27	23	8	—	—	—	—	—	—
Bigtooth aspen	27	—	17	7	—	3	—	—	—	—	—
Quaking aspen	221	—	135	48	33	3	—	—	2	—	—
Basswood	186	—	92	42	18	3	4	2	23	2	—
Elm	447	—	169	99	62	46	32	15	16	6	2
Select hardwoods	49	—	7	5	24	10	—	2	1	—	—
Other hardwoods	123	—	73	23	11	7	2	2	4	1	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	2,614	—	1,086	580	415	222	121	76	92	19	3
All species	2,681	52	1,100	580	415	222	121	76	92	20	3

Table 16.— *Net volume of growing stock and sawtimber on commercial forest land by species, Central Hardwood Unit, Minnesota, 1962 and 1977*

Species	Growing stock		Sawtimber	
	1962[1]	1977	1962[1]	1977
	Thousand cubic feet		*Thousand board feet*[2]	
SOFTWOODS:				
White pine	9,429	12,741	44,248	63,081
Red pine	5,043	13,843	23,723	42,516
Jack pine	8,900	10,151	17,026	23,144
Spruce	3,438	5,260	3,592	8,819
Balsam fir	4,024	5,913	4,162	8,944
Tamarack	25,637	24,900	23,853	48,280
Northern white-cedar	—	—	—	—
Other softwoods	—	3,261	—	4,605
Total	56,471	76,069	116,604	199,389
HARDWOODS:				
White oak	143,625	172,960	421,123	570,892
Red oak	269,754	337,603	639,317	1,290,517
Yellow birch	585	198	2,686	969
Hard maple	30,009	54,508	101,361	198,945
Soft maple	30,906	40,258	76,223	158,377
Ash	73,772	76,509	131,233	227,791
Paper birch	69,330	111,395	40,440	69,492
Aspen	213,803	284,497	169,161	445,383
Basswood	76,438	133,839	228,993	489,971
Elm	141,762	185,338	521,812	691,004
Other hardwoods	77,612	73,642	118,762	211,025
Total	1,127,596	1,470,747	2,451,111	4,354,366
All species	1,184,067	1,546,816	2,567,715	4,553,755

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.
[2]International ¼-inch rule.

Table 17.— *Cubic foot volume in all live trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)											
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
White pine	13,355	310	692	1,438	955	1,467	2,529	1,720	1,799	991	1,244	210	—
Red pine	14,095	5,633	1,441	845	692	1,126	1,293	1,183	1,075	513	294	—	—
Jack pine	10,678	2,332	3,082	3,766	1,059	274	165	—	—	—	—	—	—
White spruce	1,741	245	135	232	262	68	400	—	88	41	270	—	—
Black spruce	3,699	2,401	944	71	—	283	—	—	—	—	—	—	—
Balsam fir	6,218	2,137	2,198	928	779	145	—	31	—	—	—	—	—
Tamarack	26,048	6,317	9,541	5,062	2,605	1,711	678	73	61	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	
Other softwoods	3,892	1,268	1,213	433	529	96	128	63	88	74	—	—	—
Total	79,726	20,643	19,246	12,775	6,881	5,170	5,193	3,070	3,111	1,619	1,808	210	—
HARDWOODS:													
Select white oaks	207,233	15,623	25,015	32,366	31,651	28,520	24,849	14,621	11,418	7,619	12,326	2,835	390
Select red oaks	356,503	17,793	35,586	50,123	52,865	53,129	45,775	36,496	22,928	17,224	20,144	4,205	235
Other red oaks	12,261	136	440	759	1,174	1,573	2,313	1,787	1,357	1,037	1,618	67	—
Hickory	16,278	3,164	2,838	3,488	2,648	2,307	1,028	383	299	123	—	—	—
Yellow birch	556	50	5	49	226	103	—	95	28	—	—	—	—
Hard maple	65,598	7,779	7,473	9,517	10,103	8,343	6,366	6,793	4,137	1,556	3,273	193	65
Soft maple	44,177	9,306	7,165	4,349	3,638	3,747	3,416	2,622	1,412	1,290	3,021	2,349	1,862
Ash	85,096	17,420	20,827	15,605	11,310	8,692	4,946	2,613	1,227	828	960	374	294
Balsam poplar	14,772	2,241	3,938	4,168	2,002	688	754	429	516	—	36	—	—
Paper birch	119,506	37,365	41,216	24,274	9,720	3,480	2,834	480	—	137	—	—	—
Bigtooth aspen	34,964	3,494	8,426	8,716	7,446	3,548	1,665	1,288	189	192	—	—	—
Quaking aspen	309,375	53,736	80,880	78,685	54,340	25,700	10,732	3,100	1,669	162	371	—	—
Basswood	147,627	13,550	18,919	18,999	22,971	19,559	16,896	11,584	9,596	5,487	7,544	2,192	330
Elm	207,172	17,327	22,757	26,784	22,902	19,424	20,836	17,947	12,562	10,853	21,430	10,228	4,122
Select hardwoods	17,607	2,788	1,838	3,009	3,207	2,114	2,331	1,102	378	137	391	312	—
Other hardwoods	37,749	3,727	4,096	4,457	4,581	3,031	3,618	2,931	1,519	1,715	2,494	3,300	2,280
Noncommercial species	10,797	4,779	3,106	1,053	691	557	252	135	62	—	65	97	—
Total	1,687,271	210,278	284,525	286,401	241,475	184,515	148,611	104,406	69,297	48,360	73,673	26,152	9,578
All species	1,766,997	230,921	303,771	299,176	248,356	189,685	153,804	107,476	72,408	49,979	75,481	26,362	9,578

Table 18.—*Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Class of timber	All species	Soft-woods	Hard-woods
GROWING STOCK TREES			
Saw log trees:			
Saw log portion	591,849	26,381	565,468
Upper-stem Portion	220,839	11,149	209,690
Total sawtimber	812,688	37,530	775,158
Poletimber trees	734,128	38,539	695,589
Total growing stock	1,546,816	76,069	1,470,747
CULL TREES			
Rough and rotten cull trees:			
Sawtimber	93,272	1,801	91,471
Poletimber	86,965	1,350	85,615
Total rough and rotten cull	180,237	3,151	177,086
Short log cull trees:			
Sawtimber	39,944	506	39,438
Poletimber	—	—	—
Total short log	39,944	506	39,438
Total cull	220,181	3,657	216,524
Salvable dead trees	12,924	922	12,002
All classes	1,779,921	80,648	1,699,273

Table 19.— *Net volume of growing stock on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur
SOFTWOODS:														
White pine	12,741	133	212	36	222	38	110	340	161	17	219	192	860	11
Red pine	13,843	447	634	61	810	184	41	407	397	47	355	1,262	695	60
Jack pine	10,151	241	425	14	479	63	84	472	247	12	227	797	302	18
White spruce	1,705	6	22	1	50	6	20	—	2	1	7	43	96	2
Black spruce	3,555	21	3	3	87	25	7	1	9	5	4	140	201	8
Balsam fir	5,913	25	36	5	101	34	38	18	29	6	21	100	381	10
Tamarack	24,900	693	127	143	1,286	570	284	162	258	160	114	1,620	2,038	259
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	54	18	11	78	36	37	192	139	8	159	93	166	11
Total	76,069	1,620	1,477	274	3,113	956	621	1,592	1,242	256	1,106	4,247	4,739	379
HARDWOODS:														
Select white oak	172,960	3,849	2,969	1,117	4,487	1,411	1,501	8,986	7,425	686	15,911	3,777	9,061	803
Select red oak	326,516	5,664	4,936	1,663	6,576	2,134	2,039	16,988	16,640	845	37,486	5,809	17,321	1,131
Other red oaks	11,087	190	314	58	173	37	48	660	690	16	1,904	148	346	21
Hickory	15,522	290	367	109	293	56	47	940	1,046	41	2,699	207	515	63
Yellow birch	198	—	2	—	—	—	—	—	—	—	—	—	24	—
Hard maple	54,508	922	793	453	1,622	421	471	1,171	1,635	319	3,484	988	3,507	528
Soft maple	40,258	1,421	463	718	2,006	864	252	678	1,241	604	1,812	970	2,781	942
Ash	76,509	1,852	720	564	2,613	1,555	789	1,553	1,762	544	2,362	2,200	6,124	827
Balsam poplar	12,839	157	116	31	231	67	173	438	283	21	665	282	845	31
Paper birch	111,395	1,092	1,345	269	1,733	548	800	3,055	2,724	170	5,241	1,657	8,880	237
Bigtooth aspen	30,271	246	427	68	538	92	262	713	644	44	1,264	436	2,508	44
Quaking aspen	254,226	1,956	2,331	419	3,422	1,275	1,946	5,236	3,796	350	4,980	3,506	23,712	476
Basswood	133,839	2,800	2,219	1,006	3,946	93	1,185	4,478	4,174	748	8,694	2,616	8,105	858
Elm	185,338	4,741	2,811	1,776	6,444	2,513	1,802	6,314	6,847	1,303	14,114	4,683	10,625	1,943
Select hardwoods	14,303	261	255	75	267	109	80	807	876	29	2,239	242	576	45
Other hardwoods	30,978	1,353	530	621	1,853	405	265	1,223	1,340	479	2,658	1,029	1,391	702
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	26,794	20,598	8,947	36,204	12,425	11,660	53,240	51,123	6,199	105,513	28,550	96,321	8,651
All species	1,546,816	28,414	22,075	9,221	39,317	13,381	12,281	54,832	52,365	6,455	106,619	32,797	101,060	9,030

(Table 19 continued on next page)

(Table 19 continued)

Species	Mille Lacs	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:															
White pine	778	717	185	1,830	4,911	—	42	33	186	358	510	224	19	229	168
Red pine	545	1,215	220	694	3,425	—	31	70	799	216	336	340	62	368	122
Jack pine	219	1,095	191	667	2,699	—	10	20	601	149	308	336	15	311	149
White spruce	98	34	—	204	923	—	15	4	4	25	111	2	2	1	26
Black spruce	187	96	1	283	2,286	—	4	5	90	5	51	6	19	1	7
Balsam fir	389	141	7	730	3,225	—	14	7	174	47	259	23	19	22	52
Tamarack	1,985	2,025	140	2,601	7,399	—	136	222	151	283	1,262	342	328	32	280
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	194	347	81	373	175—	12	12	392	66	154	164	8	199	82	
Total	4,395	5,670	825	7,382	25,043	—	264	373	2,397	1,149	2,991	1,437	472	1,163	886
HARDWOODS:															
Select white oak	8,409	16,555	4,476	11,528	17,579	—	979	1,348	7,276	7,700	8,215	7,552	716	15,159	3,485
Select red oak	14,762	29,096	7,843	20,675	31,229	—	1,159	1,970	15,514	13,568	13,275	15,129	835	35,918	6,311
Other red oaks	191	1,038	316	242	164	—	15	64	704	904	232	613	2	1,782	215
Hickory	265	1,417	442	296	144	—	65	132	1,021	1,075	287	867	31	2,516	291
Yellow birch	16	2	—	26	124	—	—	—	—	—	3	—	1	—	—
Hard maple	4,366	3,001	545	6,695	9,830	—	736	692	1,311	1,555	3,835	1,100	453	3,043	1,032
Soft maple	2,638	2,260	321	3,252	7,569	—	1,098	1,116	662	956	2,060	736	920	1,368	550
Ash	6,207	5,378	770	8,490	16,758	—	789	847	1,167	1,559	5,205	1,627	845	2,128	1,274
Balsam poplar	809	983	193	1,432	3,404	—	42	43	281	285	754	350	30	653	240
Paper birch	8,239	6,609	1,370	13,047	33,398	—	321	328	2,367	2,661	5,306	2,733	281	5,270	1,714
Bigtooth aspen	2,397	1,706	328	3,707	8,928	—	116	76	582	818	1,893	615	56	1,251	512
Quaking aspen	20,579	13,097	2,244	31,996	98,872	—	704	513	2,961	3,468	12,165	4,434	723	5,664	3,401
Basswood	9,505	9,637	2,370	14,118	21,472	—	1,293	1,300	3,969	4,781	8,339	3,869	897	7,975	2,547
Elm	11,252	14,535	3,219	15,753	22,414	—	2,305	2,519	5,988	6,720	11,093	5,736	1,768	12,588	3,532
Select hardwoods	401	1,333	380	485	576	—	27	87	864	767	429	736	23	2,076	258
Other hardwoods	1,101	2,850	624	1,110	1,666	—	865	932	1,023	1,215	1,178	1,127	673	2,240	525
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	91,137	109,497	25,441	132,852	274,127	—	10,514	11,967	45,690	48,032	74,269	47,224	8,254	99,631	25,887
All species	95,532	115,167	26,266	140,234	299,170	—	10,778	12,340	48,087	49,181	77,260	48,661	8,726	100,794	26,773

Table 20.— *Net volume of sawtimber on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur
SOFTWOODS:														
White pine	63,081	646	1,087	176	1,125	163	575	1,767	818	80	1,111	930	4,240	46
Red pine	42,516	1,303	466	339	1,070	834	175	2,056	1,484	241	1,840	1,049	3,240	283
Jack pine	23,144	532	803	33	939	128	240	1,390	600	25	609	1,616	575	36
White spruce	7,172	16	113	3	235	—	93	—	3	—	32	186	354	—
Black spruce	1,647	68	—	13	63	114	6	5	40	21	15	64	129	35
Balsam fir	8,944	13	27	3	113	5	69	68	51	1	64	160	591	1
Tamarack	48,280	1,501	356	312	2,655	1,033	663	416	523	329	260	3,522	4,634	527
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	64	26	14	145	27	99	280	200	6	233	181	264	10
Total	199,389	4,143	2,878	893	6,345	2,304	1,920	5,982	3,719	703	4,164	7,708	14,027	938
HARDWOODS:														
Select white oak	570,892	14,174	10,835	4,286	15,986	4,629	4,798	32,281	25,617	2,629	55,055	12,542	27,571	2,923
Select red oak	1,237,647	23,700	20,935	7,353	26,337	8,686	7,701	65,367	67,321	3,649	162,332	21,941	56,810	4,884
Other red oaks	52,870	902	1,501	273	835	178	243	3,171	3,323	73	9,264	718	1,580	103
Hickory	31,088	631	776	258	656	99	127	1,843	2,046	115	5,539	407	884	176
Yellow birch	969	1	7	—	1	—	1	—	1	—	2	1	115	—
Hard maple	198,945	4,267	3,501	2,361	7,283	1,731	1,553	5,092	7,417	1,573	15,601	3,832	11,481	2,795
Soft maple	158,377	8,164	1,761	3,952	10,605	5,518	781	2,739	5,900	3,518	7,923	4,854	10,065	5,332
Ash	227,791	6,714	2,266	2,262	9,343	4,978	2,482	5,412	5,626	2,167	6,971	7,112	17,033	3,098
Balsam poplar	18,664	253	201	51	310	121	177	727	602	29	1,413	338	1,200	48
Paper birch	69,492	717	903	199	1,233	217	734	2,471	1,963	98	3,657	1,205	4,477	99
Bigtooth aspen	57,255	469	871	148	1,068	226	415	897	1,155	117	2,623	722	4,573	115
Quaking aspen	388,128	3,136	4,078	698	5,840	2,239	2,679	7,854	6,242	651	7,877	5,252	35,971	863
Basswood	489,971	12,315	8,679	4,614	16,132	3,585	4,491	17,826	16,171	3,484	35,314	9,793	26,315	3,707
Elm	691,004	19,318	11,485	7,618	25,459	9,616	6,278	25,309	26,903	5,569	56,593	16,804	37,196	8,068
Select hardwoods	32,630	581	676	185	542	187	120	1,776	2,221	57	6,282	426	1,015	92
Other hardwoods	128,643	6,180	2,367	3,152	8,681	1,182	923	4,816	5,822	2,438	12,131	3,950	4,883	3,475
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	101,522	70,842	37,410	130,311	43,192	33,503	177,581	178,330	26,167	388,577	89,897	241,169	35,778
All species	4,553,754	105,665	73,720	38,303	136,656	45,496	35,423	183,563	182,049	26,870	392,741	97,605	255,196	36,716

[1]International ¼-inch rule.

(Table 20 continued on next page)

(Table 20 continued)

Species	Mille Lacs	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS															
White pine	3,826	3,683	941	8,665	24,152	—	211	159	934	1,832	2,609	1,163	82	1,183	877
Red pine	2,398	3,990	1,180	2,849	8,678	—	160	372	1,403	1,155	1,553	1,684	287	1,847	580
Jack pine	299	2,810	564	1,188	5,771	—	20	50	1,574	426	678	960	25	855	398
White spruce	428	126	—	926	3,790	—	72	15	21	128	498	2	2	5	124
Black spruce	121	119	3	54	447	—	9	22	106	20	98	28	36	3	8
Balsam fir	531	251	27	1,104	4,925	—	19	2	138	29	515	57	5	77	98
Tamarack	4,416	4,617	348	5,474	10,075	—	303	479	312	617	2,822	773	552	95	666
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	248	548	114	518	318	—	29	12	142	89	333	239	5	299	162
Total	12,267	16,144	3,177	20,778	58,156	—	823	1,111	4,630	4,296	9,106	4,906	994	4,364	2,913
HARDWOODS															
Select white oak	25,140	57,408	16,447	32,725	44,873	—	3,811	5,157	25,738	28,054	25,317	26,511	2,646	52,114	11,625
Select red oak	48,264	111,121	31,232	65,230	81,417	—	4,983	8,786	65,177	59,098	48,104	58,531	3,452	151,730	23,506
Other red oak	855	4,992	1,505	1,086	396	—	70	306	3,397	4,333	1,126	2,943	9	8,654	1,034
Hickory	423	2,824	866	479	83	—	203	334	2,027	2,247	584	1,685	113	5,091	572
Yellow birch	80	9	—	125	606	—	—	—	—	—	15	—	3	1	1
Hard maple	13,302	11,747	2,302	19,618	27,859	—	3,746	3,690	5,723	6,842	11,686	4,630	2,281	13,332	3,700
Soft maple	9,433	10,315	1,367	8,525	14,757	—	5,879	6,164	2,698	4,168	7,834	3,395	5,313	5,450	1,967
Ash	17,333	17,360	2,716	23,176	42,025	—	3,281	3,375	3,571	5,053	15,532	5,458	3,247	6,184	4,016
Balsam poplar	1,015	1,429	317	1,602	4,449	—	43	67	558	514	860	618	46	1,362	314
Paper birch	5,484	4,908	1,144	9,547	13,908	—	288	211	1,763	1,899	4,921	2,048	68	3,776	1,554
Bigtooth aspen	4,931	2,605	448	7,429	17,219	—	255	177	1,102	1,647	3,739	869	152	2,402	880
Quaking aspen	32,642	19,906	3,333	49,349	144,869	—	1,193	888	4,489	6,393	19,249	6,905	1,222	8,968	5,342
Basswood	32,758	36,663	9,983	48,837	60,411	—	5,825	5,885	16,215	19,442	31,242	15,059	4,032	31,594	9,599
Elm	9,109	55,208	13,172	52,504	71,296	—	9,830	10,762	23,524	27,582	38,955	22,449	7,411	49,941	13,045
Select hardwoods	598	2,801	863	596	436	—	43	214	2,302	2,054	675	1,682	29	5,668	509
Other hardwoods	3,608	10,779	2,476	3,463	5,471	—	4,582	4,746	4,352	5,300	3,992	4,485	3,408	9,929	2,052
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	234,975	350,075	88,171	324,291	530,075	—	44,032	50,762	162,636	174,626	203,831	157,268	33,432	356,196	79,716
All species	247,242	366,219	91,348	345,069	588,231	—	44,855	51,873	167,266	178,922	222,937	162,174	34,426	360,560	82,629

Table 21.— *Net volume of growing stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, Central Hardwood Unit, Minnesota, 1977*

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				Thousand board feet[1]
SOFTWOODS:					
White pine	13,355	12,741	86	528	63,081
Red pine	14,095	13,843	44	208	42,516
Jack pine	10,678	10,151	164	363	23,144
Scotch pine	1,165	1,036	—	129	1,666
White spruce	1,741	1,705	—	36	7,172
Black spruce	3,699	3,555	—	144	1,647
Balsam fir	6,218	5,913	86	219	8,944
Tamarack	26,048	24,900	39	1,109	48,280
Northern white-cedar	—	—	—	—	—
Eastern redcedar	2,726	2,225	87	415	2,939
Total	79,726	76,069	506	3,151	199,389
HARDWOODS:					
White oak	60,895	49,850	3,520	7,525	190,290
Bur oak	146,214	123,110	6,701	16,403	380,602
Swamp white oak	124	—	—	124	—
Northern red oak	356,503	326,516	8,129	21,858	1,237,647
Black oak	2,734	2,372	—	362	10,525
Northern pin oak	9,527	8,715	385	427	42,345
Bitternut hickory	4,398	4,315	—	83	5,503
Shagbark hickory	11,880	11,207	200	473	25,585
Yellow birch	556	198	—	358	969
Sugar maple	64,857	54,110	3,220	7,527	197,281
Black maple	741	398	—	343	1,664
Red maple	22,913	20,600	—	2,313	34,765
Silver maple	21,264	19,658	559	1,047	123,611
White ash	2,088	1,993	—	95	7,509
Black ash	45,921	41,123	594	4,204	102,160
Green ash	37,087	33,393	543	3,151	118,122
Balsam poplar	14,772	12,839	—	1,933	18,664
Paper birch	119,506	111,395	759	7,352	69,492
Bigtooth aspen	34,964	30,271	471	4,222	57,255
Quakingaspen	309,375	254,226	3,274	51,875	388,128
Basswood	147,627	133,839	3,489	10,299	489,971
American elm	186,655	166,629	5,380	14,646	609,965
Slippery elm	17,777	16,253	418	1,106	70,004
Rock elm	2,740	2,456	104	180	11,035
Butternut	6,136	4,180	354	1,602	10,664
Black walnut	3,906	3,685	124	97	10,801
Black cherry	7,565	6,438	11	1,116	11,165
Boxelder	15,315	10,721	441	4,153	25,622
River birch	504	300	73	131	289
Hackberry	2,453	2,134	242	77	7,937
Eastern cottonwood	10,765	10,028	274	463	55,141
Black willow	8,712	7,795	173	744	39,654
Noncommercial	10,797	—	—	10,797	—
Total	1,687,271	1,470,747	39,438	177,086	4,354,365
All species	1,766,997	1,546,816	39,944	180,237	4,553,754

[1]International ¼-inch rule.

Table 22.— *Net volume of growing stock on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:													
White pine	12,741	304	535	1,381	900	1,461	2,479	1,648	1,799	990	1,244	—	—
Red pine	13,843	5,632	1,415	801	692	1,089	1,293	1,133	1,075	468	245	—	—
Jack pine	10,151	2,056	3,036	3,641	1,020	249	149	—	—	—	—	—	—
White spruce	1,705	245	135	196	262	68	400	—	88	41	270	—	—
Black spruce	3,555	2,356	917	—	—	282	—	—	—	—	—	—	—
Balsam fir	5,913	2,129	2,143	828	779	34	—	—	—	—	—	—	—
Tamarack	24,900	6,154	9,188	4,984	2,341	1,602	631	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	1,099	1,195	346	502	49	70	—	—	—	—	—	—
Total	76,069	19,975	18,564	12,177	6,496	4,834	5,022	2,781	2,962	1,499	1,759	—	—
HARDWOODS:													
Select white oaks	172,960	14,093	22,470	29,535	26,607	25,278	19,617	11,255	8,884	5,457	7,773	1,600	390
Select red oaks	326,516	17,118	33,795	47,206	49,287	49,922	41,564	32,736	19,904	15,185	16,466	3,147	187
Other red oaks	11,087	127	420	690	1,131	1,284	2,313	1,648	1,135	678	1,593	68	—
Hickory	15,522	3,062	2,783	3,406	2,537	2,077	918	384	232	123	—	—	—
Yellow birch	198	—	—	—	198	—	—	—	—	—	—	—	—
Hard maple	54,508	7,183	6,575	8,314	8,440	6,988	5,234	5,423	2,815	1,091	2,380	—	65
Soft maple	40,258	8,961	6,777	3,823	3,258	3,583	2,913	2,410	1,164	1,208	2,762	1,886	1,513
Ash	76,509	15,580	18,957	14,375	9,693	7,658	4,432	2,388	1,112	745	961	314	294
Balsam poplar	12,839	1,922	3,438	3,773	1,712	479	666	334	515	—	—	—	—
Paper birch	111,395	35,757	38,920	22,760	8,476	2,693	2,329	323	—	137	—	—	—
Bigtooth aspen	30,271	2,833	7,994	8,021	6,436	2,564	1,172	953	106	192	—	—	—
Quaking aspen	254,226	44,637	68,670	65,570	45,827	19,117	7,218	1,792	961	162	272	—	—
Basswood	133,839	12,470	17,306	17,662	20,255	17,336	15,591	10,952	9,163	4,989	6,147	1,782	186
Elm	185,338	16,629	21,731	23,060	21,373	17,753	19,267	16,591	11,074	9,373	17,808	7,983	2,696
Select hardwoods	14,303	2,335	1,530	2,624	2,660	1,681	2,045	896	287	90	155	—	—
Other hardwoods	30,978	3,243	3,543	3,911	3,510	2,255	3,204	2,381	1,291	1,170	1,749	2,593	2,128
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	185,950	254,909	254,730	211,400	160,668	128,483	90,466	58,643	40,600	58,066	19,373	7,459
All species	1,546,816	205,925	273,473	266,907	217,896	165,502	133,505	93,247	61,605	42,099	59,825	19,373	7,459

Table 23.— *Net volume of sawtimber on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	65,081	7,536	4,364	8,115	12,480	8,924	9,629	5,420	6,613	—	—
Red pine	42,516	6,536	4,575	6,649	7,486	7,009	6,345	2,602	1,314	—	—
Jack pine	23,144	16,711	4,693	1,149	591	—	—	—	—	—	—
White spruce	7,172	1,384	1,643	288	2,058	—	429	185	1,185	—	—
Black spruce	1,647	—	—	1,647	—	—	—	—	—	—	—
Balsam fir-8,944	4,691	4,046	207	—	—	—	—	—	—	—	
Tamarack	48,280	26,451	11,701	7,400	2,728	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	1,941	2,185	204	275	—	—	—	—	—	—
Total	199,389	65,250	33,207	25,659	25,618	15,933	16,403	8,207	9,112	—	—
HARDWOODS:											
Select white oaks	570,892	—	142,321	136,166	107,179	59,429	47,231	28,028	40,076	8,426	2,036
Select red oaks	1,237,647	—	263,736	271,297	229,034	178,267	107,507	81,548	88,873	16,284	1,101
Other red oaks	52,870	—	6,151	6,891	12,124	8,945	6,135	3,669	8,550	405	—
Hickory	31,088	—	12,338	11,226	4,312	1,637	1,051	524	—	—	—
Yellow birch	969	—	969	—	—	—	—	—	—	—	—
Hard maple	198,945	—	51,653	42,240	32,797	33,567	17,982	6,487	13,765	—	454
Soft maple	158,376	—	32,419	30,309	23,475	18,953	9,524	8,650	17,889	10,338	6,819
Ash	227,791	—	91,663	62,138	33,355	18,726	7,657	5,031	5,954	1,762	1,505
Balsam poplar	18,664	—	8,374	2,414	3,599	1,693	2,584	—	—	—	—
Paper birch	69,492	—	41,526	13,191	12,219	1,761	—	795	—	—	—
Bigtooth aspen	57,255	—	32,650	12,381	6,347	4,527	484	866	—	—	—
Quaking aspen	388,128	—	237,184	98,323	37,484	8,635	4,490	761	1,251	—	—
Basswood	489,971	—	114,190	98,792	89,476	62,643	53,411	27,472	33,536	9,553	898
Elm	691,004	—	121,575	101,363	107,495	92,441	61,732	51,212	98,179	42,537	14,470
Select hardwoods	32,630	—	9,737	6,672	8,574	4,226	1,679	640	1,102	—	—
Other hardwoods	128,643	—	26,193	15,771	23,382	16,378	7,832	7,090	9,553	12,597	9,847
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	—	1,192,679	909,174	730,852	511,828	329,299	222,773	318,728	101,902	37,130
All species	4,553,754	65,250	1,225,885	934,834	756,471	527,760	345,702	230,980	327,840	101,902	37,130

[1]International ¼-inch rule.

Table 24.— *Net volume of growing stock on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS																
White pine	12,741	122	—	5,631	355	—	130	—	111	957	225	2,633	1,489	1,088	—	—
Red pine	13,843	1,390	6,249	895	—	—	—	—	—	1,565	—	—	2,866	878	—	—
Jack pine	10,151	6,629	1,107	—	—	—	—	—	—	62	—	—	2,001	352	—	—
White spruce	1,705	—	—	—	251	—	—	—	53	57	206	287	405	81	365	—
Black spruce	3,555	—	—	—	596	—	1,722	—	399	—	71	75	636	56	—	—
Balsam fir	5,913	89	—	—	1,769	—	295	—	72	—	493	587	1,751	857	—	—
Tamarack	24,900	—	86	—	528	—	1,325	—	17,148	—	1,005	1,970	1,540	853	214	231
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	—	589	—	—	—	—	—	—	1,590	—	879	45	158	—	—
Total	76,069	8,230	8,031	6,526	3,499	—	3,472	—	17,783	4,231	2,000	6,431	10,733	4,323	579	231
HARDWOODS																
Select white oaks	172,960	31	—	303	—	—	—	—	—	121,445	2,123	30,710	15,603	2,468	151	126
Select red oaks	326,516	—	295	463	—	—	85	—	146	249,221	434	33,920	35,258	6,577	117	—
Other red oaks	11,087	—	—	—	—	—	—	—	—	8,678	317	1,461	497	—	134	—
Hickory	15,522	—	—	—	—	—	—	—	—	12,289	—	2,591	—	642	—	—
Yellow birch	198	—	—	—	—	—	—	—	—	—	198	—	—	—	—	—
Hard maple	54,508	—	—	—	—	—	—	—	—	4,025	759	46,208	3,387	129	—	—
Soft maple	40,258	—	—	65	52	—	—	—	80	2,192	17,809	10,443	8,408	1,209	—	—
Ash	76,509	—	—	267	—	—	89	—	23	5,715	27,731	33,549	7,308	1,348	307	172
Balsam poplar	12,839	—	—	—	—	—	—	—	124	678	—	1,387	6,018	346	4,286	—
Paper birch	111,395	149	294	475	126	—	320	—	—	22,391	1,099	15,903	37,537	32,761	170	170
Bigtooth aspen	30,271	—	—	—	—	59	—	—	4,846	—	3,470	20,749	1,147	—	—	—
Quaking aspen	254,226	742	695	130	253	—	663	—	296	23,814	1,774	17,603	199,770	7,831	277	378
Basswood	133,839	—	—	—	62	—	—	—	—	17,946	2,092	100,290	12,170	1,279	—	—
Elm	185,338	—	—	—	—	—	—	—	426	30,915	17,353	117,704	13,527	4,287	750	376
Select hardwoods	14,303	—	—	—	—	—	—	—	—	8,287	308	4,100	1,253	230	67	58
Other hardwoods	30,978	—	—	—	—	—	—	—	—	2,989	16,055	10,126	1,465	—	—	343
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	922	1,284	1,703	493	—	1,216	—	1,095	515,431	88,052	429,465	362,950	60,254	6,259	1,623
All species	1,546,816	9,152	9,315	8,229	3,992	—	4,688	—	18,878	519,662	90,052	435,896	373,683	64,577	6,838	1,854

Table 25.— *Net volume of sawtimber on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS																
White pine	63,081	432	—	26,897	2,006	—	442	—	370	5,592	654	13,744	7,595	5,349	—	—
Red pine	42,516	2,573	7,933	5,669	—	—	—	—	—	7,296	—	—	13,872	5,173	—	—
Jack pine	23,144	16,923	2,819	—	—	—	—	—	—	293	—	—	2,019	1,090	—	—
White spruce	7,172	—	—	—	1,245	—	—	—	—	—	185	1,194	2,330	520	1,698	—
Black spruce	1,647	—	—	—	469	—	—	—	—	—	—	—	1,178	—	—	—
Balsam fir	8,944	221	—	—	3,571	—	—	—	—	—	610	985	3,005	552	—	—
Tamarack	48,280	—	—	—	635	—	1,327	—	32,864	—	2,209	4,987	3,633	1,570	1,055	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	—	—	—	—	—	—	—	—	3,054	—	1,551	—	—	—	—
Total	199,389	20,149	10,752	32,566	7,926	—	1,769	—	33,234	16,235	3,658	22,461	33,632	14,254	2,753	—
HARDWOODS																
Select white oaks	570,892	—	—	552	—	—	—	—	—	397,551	8,498	115,997	36,913	10,298	824	259
Select red oaks	1,237,647	—	—	2,376	—	—	—	—	795	966,136	439	138,283	104,604	24,378	636	—
Other red oaks	52,870	—	—	—	—	—	—	—	—	—	41,247	1,718	7,286	1,894	—	725
Hickory	31,088	—	—	—	—	—	—	—	—	23,196	—	5,034	—	2,858	—	—
Yellow birch	969	—	—	—	—	—	—	—	—	—	969	—	—	—	—	—
Hard maple	198,945	—	—	—	—	—	—	—	—	12,208	2,286	176,692	7,759	—	—	—
Soft maple	158,376	—	—	346	—	—	—	—	—	7,695	109,233	33,482	6,782	838	—	—
Ash	227,791	—	—	368	—	—	—	—	—	3,728	74,324	124,163	11,083	2,336	887	902
Balsam poplar	18,664	—	—	—	—	—	—	—	—	2,362	—	4,193	7,929	415	3,765	—
Paper birch	69,492	—	—	1,090	—	—	—	—	—	16,257	1,188	25,094	15,89	9,965	—	—
Bigtooth aspen	57,255	—	—	—	—	—	—	—	—	11,574	—	11,745	30,386	3,550	—	—
Quaking aspen	388,128	—	1,367	618	—	—	476	—	—	39,515	3,171	42,946	277,917	21,053	600	465
Basswood	489,971	—	—	—	343	—	—	—	—	53,703	7,393	402,765	23,482	2,285	—	—
Elm	691,004	—	—	—	—	—	—	—	—	103,628	58,669	479,180	32,428	12,774	2,877	1,448
Select hardwoods	32,630	—	—	—	—	—	—	—	—	18,453	—	11,990	1,510	677	—	—
Other hardwoods	128,643	—	—	—	—	—	—	—	—	9,499	69,360	43,706	4,153	—	—	1,925
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	—	1,367	5,350	343	—	476	—	795	1,716,752	337,248	1,622,556	562,738	91,427	10,314	4,999
All species	4,553,754	20,149	12,119	37,916	8,269	—	2,245	—	34,029	1,732,987	340,906	1,645,017	596,370	105,681	13,067	4,999

[1]International ¼-inch rule.

Table 26.— *Net volume of growing stock on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:														
White pine	12,741	—	—	—	—	995	310	—	10,127	—	114	1,195	—	—
Red pine	13,843	—	—	—	110	2,664	760	—	5,041	—	—	5,268	—	—
Jack pine	10,151	—	—	—	—	1,335	—	297	4,116	—	—	4,403	—	—
White spruce	1,705	—	—	—	—	321	—	—	832	—	—	552	—	—
Black spruce	3,555	—	—	—	—	1,961	—	—	442	—	77	1,075	—	—
Balsam fir	5,913	—	—	—	—	2,104	—	—	1,419	—	—	2,390	—	—
Tamarack	24,900	—	—	—	—	2,488	—	—	14,011	—	383	8,018	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	3,261	—	—	—	—	589	—	—	2,298	—	49	325	—	—
Total	76,069	—	—	—	110	12,457	1,070	297	38,286	—	623	23,226	—	—
HARDWOODS:														
Select white oaks	172,960	—	—	375	90	9,881	1,566	31	132,300	—	3,993	24,596	—	128
Select red oaks	326,516	—	—	749	1,782	34,940	5,804	—	218,131	—	10,908	54,202	—	—
Other red oaks	11,087	—	—	—	380	1,036	—	—	9,294	—	—	377	—	—
Hickory	15,522	—	—	191	327	246	115	—	13,444	—	—	1,199	—	—
Yellow birch	198	—	—	—	—	109	89	—	—	—	—	—	—	—
Hard maple	54,508	—	—	216	195	8,330	2,528	—	35,814	—	444	6,981	—	—
Soft maple	40,258	—	—	225	13,286	3,872	1,001	—	13,557	—	1,069	7,248	—	—
Ash	76,509	—	—	—	3,900	8,959	3,540	—	40,619	—	3,362	16,129	—	—
Balsam poplar	12,839	—	—	—	—	600	81	—	10,177	—	51	1,930	—	—
Paper birch	111,395	—	—	247	241	21,827	3,615	—	49,230	—	5,134	31,101	—	—
Bigtooth aspen	30,271	—	—	245	—	5,912	1,536	—	11,266	—	993	10,319	—	—
Quaking aspen	254,226	—	—	338	394	48,022	14,020	—	98,853	—	16,041	76,558	—	—
Basswood	133,839	—	—	1,660	364	9,265	4,981	—	89,782	—	3,903	23,134	—	750
Elm	185,338	—	—	65	5,421	12,382	2,550	—	134,264	—	3,535	25,601	—	1,520
Select hardwoods	14,303	—	—	—	—	1,506	191	—	10,804	—	485	1,317	—	—
Other hardwoods	30,978	—	—	—	3,749	1,903	—	—	21,465	—	958	2,903	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1,470,747	—	—	4,311	30,129	168,790	41,617	31	889,000	—	50,876	283,595	—	2,398
All species	1,546,816	—	—	4,311	30,239	181,247	42,687	328	927,286	—	51,499	306,821	—	2,398

Table 27.— *Net volume of sawtimber on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1977*
(In thousand board feet)[1]

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:														
White pine	63,081	—	—	—	—	4,154	1,761	—	50,830	—	610	5,726	—	—
Red pine	42,516	—	—	—	609	9,078	4,452	—	22,475	—	—	5,902	—	—
Jack pine	23,144	—	—	—	—	375	—	156	11,134	—	—	11,479	—	—
White spruce	7,172	—	—	—	—	1,698	—	—	3,718	—	—	1,756	—	—
Black spruce	1,647	—	—	—	—	470	—	—	1,177	—	—	—	—	—
Balsam fir	8,944	—	—	—	—	1,050	—	—	4,109	—	—	3,785	—	—
Tamarack	48,280	—	—	—	—	7,128	—	—	28,448	—	442	12,262	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	4,605	—	—	—	—	—	—	—	2,939	—	204	1,462	—	—
Total	199,389	—	—	—	609	23,953	6,213	156	124,830	—	1,256	42,372	—	—
HARDWOODS:														
Select white oaks	570,892	—	—	—	—	25,571	1,391	—	462,569	—	10,987	69,847	—	527
Select red oaks	1,237,647	—	—	1,363	5,626	111,614	14,225	—	886,300	—	28,439	190,080	—	—
Other red oaks	52,870	—	—	—	2,058	3,007	—	—	46,602	—	—	1,203	—	—
Hickory	31,088	—	—	—	637	285	545	—	28,688	—	—	933	—	—
Yellow birch	969	—	—	—	—	527	442	—	—	—	—	—	—	—
Hard maple	198,945	—	—	591	1,150	20,716	11,976	—	143,719	—	499	20,294	—	—
Soft maple	158,376	—	—	—	80,666	5,577	677	—	55,300	—	1,272	14,884	—	—
Ash	227,791	—	—	—	18,833	20,495	12,678	—	127,518	—	8,080	40,187	—	—
Balsam poplar	18,664	—	—	—	—	480	—	—	15,832	—	—	2,352	—	—
Paper birch	69,492	—	—	—	—	12,949	1,772	—	37,781	—	3,011	13,979	—	—
Bigtooth aspen	57,255	—	—	601	—	11,499	3,808	—	24,630	—	800	15,917	—	—
Quaking aspen	388,128	—	—	982	—	80,040	19,107	—	142,499	—	28,738	116,762	—	—
Basswood	489,971	—	—	2,355	1,202	28,188	7,757	—	363,303	—	11,297	71,918	—	3,951
Elm	691,004	—	—	—	23,195	36,792	6,608	—	512,818	—	11,821	92,481	—	7,289
Select hardwoods	32,630	—	—	—	—	3,129	—	—	26,893	—	802	1,806	—	—
Other hardwoods	128,643	—	—	—	21,089	8,243	—	—	91,159	—	3,026	5,126	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,354,365	—	—	5,892	154,456	369,112	80,986	—	2,965,611	—	108,772	657,769	—	11,767
All species	4,553,754	—	—	5,892	155,065	393,065	87,199	156	3,090,441	—	110,028	700,141	—	11,767

[1]International ¼-inch rule.

Table 28.— *Net volume of growing stock on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	9,152	—	—	1,070	3,799	2,667	—	1,616	—	—	—	—	—	—
Red pine	9,315	—	3,530	1,720	—	1,471	—	—	—	2,594	—	—	—	—
White pine	8,229	—	—	—	—	—	3,342	3,573	1,314	—	—	—	—	—
Balsam fir	3,992	—	230	—	—	3,426	336	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	4,688	—	72	1,883	107	211	1,719	696	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	18,878	—	1,370	348	278	5,389	3,771	1,630	355	1,809	958	1,413	1,557	—
Oak	519,662	1,792	5,925	1,246	31,038	74,696	83,296	99,557	58,395	58,204	62,605	37,641	5,267	—
Elm-ash-cottonwood	90,052	2,621	3,121	2,479	1,928	18,923	19,193	15,943	13,860	2,452	7,267	555	1,710	—
Maple-basswood	435,896	5,303	4,336	7,419	29,079	50,437	72,177	86,746	83,935	42,451	19,610	30,057	4,346	—
Aspen	373,683	17,658	13,962	20,649	96,640	124,004	69,045	20,411	9,522	1,792	—	—	—	—
Paper birch	64,577	264	869	1,928	11,868	21,039	13,981	5,628	4,142	4,593	—	265	—	—
Balsam poplar	6,838	151	365	—	—	2,973	2,520	—	—	829	—	—	—	—
Nonstocked	1,854	1,637	71	—	—	47	—	—	99	—	—	—	—	—
All types	1,546,816	29,426	33,851	38,742	174,737	305,283	269,380	235,800	171,622	114,724	90,440	69,931	12,880	—

Table 29.— *Net volume of sawtimber on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Jack pine	20,149	—	—	2,050	5,813	5,640	—	6,646	—	—	—	—	—	—
Red pine	12,119	—	—	1,033	—	2,538	—	—	—	8,548	—	—	—	—
White pine	37,916	—	—	—	—	—	15,180	17,406	5,330	—	—	—	—	—
Balsam fir	8,269	—	—	—	—	6,904	1,365	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	2,245	—	—	2,245	—	—	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	34,029	—	1,433	—	285	4,205	8,348	4,966	442	5,548	3,650	3,343	1,809	—
Oak	1,732,987	5,798	18,550	2,725	58,952	147,618	250,437	327,801	212,323	242,769	271,256	171,188	23,570	—
Elm-ash-cottonwood	340,906	5,568	7,204	5,942	6,406	59,253	65,833	74,588	66,911	8,893	27,307	2,245	10,756	—
Maple-basswood	1,645,017	17,067	11,972	12,162	59,289	132,003	247,164	350,611	365,486	195,417	92,600	139,941	21,305	—
Aspen	596,370	38,246	21,508	15,840	113,607	167,587	150,259	46,083	37,523	5,717	—	—	—	—
Paper birch	105,681	690	1,014	1,106	17,806	26,213	19,612	11,034	13,277	14,139	—	790	—	—
Balsam poplar	13,067	824	1,698	—	—	4,514	4,976	—	—	1,055	—	—	—	—
Nonstocked	4,999	3,753	—	—	—	510	—	—	736	—	—	—	—	—
All types	4,553,754	71,946	63,379	43,103	262,158	556,985	763,174	839,135	702,028	482,086	394,813	317,507	57,440	—

[1]International ¼-inch rule.

Table 30.— *Net volume of short-log trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	86	—	—	—	—	—	—	—	—	86	—
Red pine	44	44	—	—	—	—	—	—	—	—	—
Jack pine	164	125	39	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	86	86	—	—	—	—	—	—	—	—	—
Tamarack	39	—	39	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	87	87	—	—	—	—	—	—	—	—	—
Total	506	342	78	—	—	—	—	—	—	86	—
HARDWOODS:											
Select white oaks	10,221	—	2,357	1,011	2,140	1,300	1,013	894	940	566	—
Select red oaks	8,129	—	1,126	1,641	1,216	1,367	634	1,021	976	148	—
Other red oaks	385	—	43	115	—	71	89	67	—	—	—
Hickory	200	—	37	96	—	—	67	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—
Hard maple	3,220	—	505	634	598	383	701	—	309	90	—
Soft maple	559	—	—	28	44	18	—	—	—	120	349
Ash	1,137	—	455	316	176	134	56	—	—	—	—
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—
Paper birch	759	—	298	329	132	—	—	—	—	—	—
Bigtooth aspen	471	—	260	128	—	83	—	—	—	—	—
Quaking aspen	3,274	—	1,520	856	720	79	—	—	99	—	—
Basswood	3,489	—	1,035	692	440	66	144	90	894	128	—
Elm	5,902	—	801	636	642	524	766	511	901	618	503
Select hardwoods	489	—	6	83	181	73	—	45	101	—	—
Other hardwoods	1,203	—	335	225	62	88	49	62	211	171	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	39,438	—	8,778	6,790	6,351	4,186	3,519	2,690	4,431	1,841	852
All species	39,944	342	8,856	6,790	6,351	4,186	3,519	2,690	4,431	1,927	852

Table 31.— *Net volume of short-log trees on commercial forest land by species and diameter class, Central Hardwood Unit, Minnesota, 1977*

(In thousand board feet)[1]

Species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS:											
White pine	330	—	—	—	—	—	—	—	—	330	—
Red pine	242	242	—	—	—	—	—	—	—	—	—
Jack pine	614	382	232	—	—	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—
Black spruce	—	—	—	—	—	—	—	—	—	—	—
Balsam fir	262	262	—	—	—	—	—	—	—	—	—
Tamarack	434	—	434	—	—	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	
Other softwoods	507	507	—	—	—	—	—	—	—	—	—
Total	2,389	1,393	666	—	—	—	—	—	—	330	—
HARDWOODS:											
Select white oaks	35,004	—	9,674	3,362	6,991	3,909	2,690	2,802	3,469	2,107	—
Select red oaks	24,645	—	4,085	5,563	3,676	3,716	1,616	2,867	2,595	527	—
Other red oaks	1,253	—	138	474	—	201	250	190	—	—	—
Hickory	700	—	119	381	—	—	200	—	—	—	—
Yellow birch	—	—	—	—	—	—	—	—	—	—	—
Hard maple	7,602	—	1,450	1,355	1,322	876	1,540	—	780	279	—
Soft maple	2,175	—	—	326	349	123	—	—	—	319	1,058
Ash	2,555	—	1,438	672	144	158	143	—	—	—	—
Balsam poplar	—	—	—	—	—	—	—	—	—	—	—
Paper birch	1,449	—	617	581	251	—	—	—	—	—	—
Bigtooth aspen	762	—	367	172	—	223	—	—	—	—	—
Quaking aspen	6,149	—	2,579	1,493	1,383	194	—	—	500	—	—
Basswood	9,850	—	1,917	1,227	751	117	344	300	4,205	989	—
Elm	24,268	—	3,593	2,733	2,371	2,155	2,514	1,713	3,552	2,486	3,151
Select hardwoods	1,656	—	56	30	743	386	—	203	238	—	—
Other hardwoods	6,048	—	1,695	952	552	572	341	363	514	1,059	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—
Total	124,116	—	27,728	19,321	18,533	12,630	9,638	8,438	15,853	7,766	4,209
All species	126,505	1,393	28,394	19,321	18,533	12,630	9,638	8,438	15,853	8,096	4,209

[1]International ¼-inch rule.

Table 32.—*Net annual growth of growing stock on commercial forest land by softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1961 and 1976*

(In thousand cubic feet)

Species	1961[1]	1976
Softwoods	2,243	3,562
Hardwoods	43,656	58,733
All species	45,899	62,295

[1]Figures have been adjusted from those published after the 1962 survey to conform to 1977 volumes because of changes in survey definitions and procedures.

Table 33.— *Net annual growth of growing stock on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	453	2	8	1	3	—	2	16	7	—	11	2	30	—	26
Red pine	1,113	40	90	2	103	6	2	16	28	2	12	175	26	2	21
Jack pine	649	21	68	–1	66	–1	—	9	15	–1	5	121	–1	–2	–2
White spruce	126	1	2	—	2	1	—	—	—	—	—	2	6	—	4
Black spruce	211	2	—	—	5	1	—	—	—	—	—	9	13	—	12
Balsam fir	402	2	2	—	7	3	2	2	3	1	2	6	28	1	28
Tamarack	508	-6	6	—	24	–36	10	5	–10	–4	–2	37	21	–7	24
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	100	1	1	—	2	1	1	6	4	—	5	2	5	—	6
Total	3,562	63	177	2	212	–25	17	54	47	–2	33	354	128	–6	119
HARDWOODS:															
Select white oak	4,294	67	74	22	88	–6	39	224	171	9	388	75	224	6	207
Select red oak	9,025	139	107	39	186	88	48	366	393	25	763	170	624	38	552
Other red oaks	214	4	6	1	3	1	1	12	16	—	36	3	7	—	4
Hickory	429	8	10	3	8	2	1	26	29	1	74	5	15	2	8
Yellow birch	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hard maple	4,335	62	54	26	110	33	40	84	112	19	237	77	299	31	379
Soft maple	2,940	57	27	25	83	41	19	39	58	21	82	53	250	34	230
Ash	1,538	44	19	14	67	24	20	10	18	12	35	58	126	19	121
Balsam poplar	833	11	8	2	16	5	11	26	18	2	45	19	55	2	53
Paper birch	3,761	37	43	9	59	16	35	124	103	5	218	62	277	7	243
Bigtooth aspen	332	2	14	1	8	—	5	-24	–14	1	5	2	5	1	33
Quaking aspen	11,430	92	118	19	152	68	107	313	197	15	269	162	1,012	20	869
Basswood	8,516	153	103	51	228	57	78	273	222	39	370	168	613	47	640
Elm	10,307	224	101	66	326	152	130	257	186	61	121	284	797	81	928
Select hardwoods	306	6	7	2	6	3	3	9	14	1	52	5	10	1	10
Other hardwoods	470	–6	14	2	2	–13	8	32	30	–6	74	11	16	1	7
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	58,733	900	705	282	1,342	471	545	1,771	1,553	205	2,769	1,154	4,330	290	4,284
All species	62,295	963	882	284	1,554	446	562	1,825	1,600	203	2,802	1,508	4,458	284	4,403

(Table 33 continued on next page)

(Table 33 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	22	8	62	186	—	1	—	9	15	15	10	—	11	6
Red pine	95	7	32	310	—	1	3	85	7	13	13	2	15	5
Jack pine	51	3	13	220	—	—	–2	56	2	–1	4	–2	7	1
White spruce	2	—	9	89	—	—	—	—	1	6	—	—	—	1
Black spruce	5	—	18	139	—	—	—	4	—	2	—	1	—	—
Balsam fir	11	1	51	212	—	1	1	9	3	17	2	2	2	3
Tamarack	26	5	89	316	—	1	–2	3	2	2	—	–4	—	8
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	10	2	13	6	—	—	—	16	2	4	5	—	6	2
Total	222	26	287	1,478	—	4	—	182	32	58	34	–1	41	26
HARDWOODS:														
Select white oak	386	110	332	635	—	19	24	178	183	191	180	4	376	88
Select red oak	698	161	762	1,482	—	32	47	329	272	405	350	35	753	161
Other red oak	19	6	5	5	—	—	1	13	17	4	12	—	34	4
Hickory	39	12	9	6	—	2	3	28	28	8	24	1	69	8
Yellow birch	—	—	—	3	—	—	—	—	—	—	—	—	—	—
Hard maple	234	41	588	893	—	43	39	92	108	332	81	27	211	83
Soft maple	143	18	320	955	—	38	39	36	49	147	40	34	68	34
Ash	100	10	172	418	—	19	21	14	29	95	15	19	20	19
Balsam poplar	63	12	93	218	—	3	3	18	19	49	22	2	43	15
Paper birch259	54	394	1,037	—	11	11	93	98	172	107	7	217	63	
Bigtooth aspen	–16	-8	54	287	—	3	2	-5	18	-10	–20	2	–9	–5
Quaking aspen	692	131	1,384	4,055	—	35	22	165	198	569	246	29	312	179
Basswood	621	136	898	1,900	—	70	67	192	243	544	230	49	363	161
Elm	749	134	1,404	2,270	—	102	92	136	185	867	219	85	134	216
Select hardwoods	19	5	16	30	—	1	2	17	18	12	9	1	43	4
Other hardwoods	50	13	27	39	—	2	4	28	27	15	19	–9	69	14
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4,056	835	6,458	14,233	—	380	377	1,334	1,492	3,400	1,534	286	2,703	1,044
All species	4,278	861	6,745	15,711	—	384	377	1,516	1,524	3,458	1,568	285	2,744	1,070

Table 34.— *Net annual growth of sawtimber on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	2,560	2	41	2	2	–3	10	66	28	–2	46	–7	211	–6	162
Red pine	1,064	31	11	7	27	20	3	56	41	6	49	27	77	7	57
Jack pine	981	24	80	–2	66	–2	6	62	28	–2	23	134	–3	–4	–14
White spruce	347	—	3	—	6	—	2	—	—	—	2	4	13	—	11
Black spruce	10	—	—	—	—	1	—	—	—	—	—	—	3	—	1
Balsam fir	864	1	1	—	6	—	3	5	4	—	5	8	27	—	24
Tamarack	2,743	39	22	10	180	–54	37	26	–7	2	1	227	138	1	150
Other softwoods	71	1	—	—	2	—	2	4	3	—	3	3	4	—	4
Total	8,640	98	158	17	289	–38	63	219	97	4	129	396	470	–2	395
HARDWOODS:															
Select white oak	16,546	328	307	101	422	–20	158	1,015	797	40	1,806	366	723	37	603
Select red oak	38,201	545	577	167	782	253	206	1,700	2,052	83	4,669	678	2,032	130	1,973
Other red oaks	909	14	26	5	15	3	4	52	58	1	160	12	28	2	16
Hickory	1,456	33	26	6	23	5	23	152	70	3	154	30	42	4	14
Yellow birch	18	—	—	—	—	—	—	—	—	—	—	—	2	—	2
Hard maple	19,508	451	309	188	597	138	178	493	580	116	1,371	413	1,152	162	1,429
Soft maple	10,481	357	55	111	425	412	76	249	350	120	357	336	847	191	932
Ash	5,078	193	174	140	342	83	–9	117	253	90	365	91	278	184	–2
Balsam poplar	812	11	10	3	14	6	7	29	29	1	75	14	52	3	43
Paper birch	3,715	47	63	8	104	44	21	81	72	9	103	72	338	14	316
Bigtooth aspen	–665	–4	21	1	–13	–1	–20	–88	–50	1	–19	–32	–12	2	–109
Quaking aspen	34,262	231	281	50	420	262	203	417	444	53	508	417	3,665	83	2,888
Basswood	27,208	614	477	234	871	191	222	1,157	966	169	1,672	532	1,619	201	1,798
Elm	34,852	947	291	232	1,275	809	496	950	615	252	131	1,186	2,763	311	3,155
Select hardwoods	1,564	24	37	9	24	6	4	65	111	2	356	15	37	4	22
Other hardwoods	3,358	127	63	88	200	19	15	153	197	56	352	74	137	103	74
Total	197,303	3,918	2,717	1,343	5,501	2,210	1,584	6,542	6,544	996	12,060	4,204	13,703	1,431	13,154
All species	205,943	4,016	2,875	1,360	5,790	2,172	1,647	6,761	6,641	1,000	12,189	4,600	14,173	1,429	13,549

[1]International ¼-inch rule.

(Table 34 continued on next page)

(Table 34 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	81	32	349	1,273	—	2	–2	35	61	70	35	–2	50	24
Red pine	105	30	73	197	—	4	9	38	29	38	47	7	52	16
Jack pine	121	23	5	251	—	–2	–3	83	16	9	36	–4	37	13
White spruce	3	—	26	253	—	1	—	1	2	18	—	—	—	2
Black spruce	1	—	—	3	—	—	—	1	—	—	—	—	—	—
Balsam fir	14	2	57	658	—	1	—	5	2	26	4	—	6	5
Tamarack	208	23	270	1,277	—	10	12	9	16	66	27	21	1	31
Other softwoods	12	2	8	5	—	—	—	2	1	5	3	—	4	3
Total	545	112	788	3,917	—	16	16	174	127	232	152	22	150	94
HARDWOODS:														
Select white oak	1,722	497	953	1,268	—	82	113	812	799	646	834	20	1,749	368
Select red oak	3,005	752	2,914	3,344	—	132	202	1,850	1,542	1,667	1,664	87	4,450	745
Other red oak		25	20	8	—	1	5	58	76	19	50	—	150	18
Hickory	243	65	22	2	—	5	10	69	78	61	108	2	164	42
Yellow birch	—	—	2	12	—	—	—	—	—	—	—	—	—	—
Hard maple	1,201	321	2,176	3,150	—	226	250	586	650	1,337	419	137	1,135	343
Soft maple	851	109	1,013	1,179	—	146	175	173	195	838	288	188	325	183
Ash	262	41	–195	1,433	—	216	228	121	308	–178	96	145	271	31
Balsam poplar	59	13	64	176	—	2	4	28	26	33	26	2	70	12
Paper birch	195	35	421	1,138	—	27	17	49	91	201	74	16	99	60
Bigtooth aspen	–140	–32	–197	404	—	–3	3	–27	16	–187	–70	6	–56	–59
Quaking aspen	1,325	171	4,337	15,000	—	85	64	272	309	1,342	418	130	553	334
Basswood	2,246	580	2,484	3,705	—	307	304	852	1,074	1,593	951	198	1,620	571
Elm	2,958	515	4,492	6,671	—	325	307	364	599	3,011	855	357	232	753
Cottonwood	104	34	25	18	—	2	11	121	110	24	69	1	310	19
Black walnut		62	71	121	—	135	138	123	138	75	125	82	303	65
Other hardwoods	262	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	14,376	3,188	18,602	37,629	—	1,688	1,831	5,451	6,011	10,482	5,907	1,371	11,375	3,485
All species	14,921	3,300	19,390	41,546	—	1,704	1,847	5,625	6,138	10,714	6,059	1,393	11,525	3,579

Table 35.— *Net annual growth of growing stock on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All owners	Ownership class												
		National forest	Bureau of Land Mgmt.	Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Farmer owned-leased	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-corp., leased	Misc. priv.-indiv., leased
SOFTWOODS:														
White pine	453	—	—	—	—	–22	12	—	413	—	2	48	—	—
Red pine	1,113	—	—	—	2	125	16	—	199	—	—	771	—	—
Jack pine	649	—	—	—	—	–76	—	10	282	—	—	433	—	—
White spruce	126	—	—	—	—	37	—	—	35	—	—	54	—	—
Black spruce	211	—	—	—	—	113	—	—	19	—	5	74	—	—
Balsam fir	402	—	—	—	—	124	—	—	84	—	—	194	—	—
Tamarack	508	—	—	—	—	92	—	—	–18	—	22	412	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	100	—	—	—	—	26	—	—	69	—	—	5	—	—
Total	3,562	—	—	—	2	419	28	10	1,083	—	29	1,991	—	—
HARDWOODS:														
Select white oaks	4,294	—	—	15	6	504	55	1	3,302	—	110	298	—	3
Select red oaks	9,025	—	—	31	54	997	230	—	5,035	—	113	2,565	—	—
Other red oaks	214	—	—	—	6	26	—	—	172	—	—	10	—	—
Hickory	429	—	—	8	9	6	1	—	364	—	—	41	—	—
Yellow birch	3	—	—	—	—	2	1	—	—	—	—	—	—	—
Hard maple	4,335	—	—	23	14	787	198	—	2,655	—	50	608	—	—
Soft maple	2,940	—	—	20	389	614	87	—	867	—	85	878	—	—
Ash	1,538	—	—	—	–104	269	94	—	721	—	102	456	—	—
Balsam poplar	833	—	—	—	—	40	5	—	627	—	6	155	—	—
Paper birch	3,761	—	—	6	8	870	94	—	1,622	—	121	1,040	—	—
Bigtooth aspen	332	—	—	12	—	299	62	—	–196	—	43	112	—	—
Quaking aspen	11,430	—	—	19	30	2,540	–964	—	4,309	—	857	4,639	—	—
Basswood	8,516	—	—	173	29	684	452	—	5,224	—	280	1,637	—	37
Elm	10,307	—	—	9	153	1,050	209	—	6,960	—	298	1,522	—	106
Select hardwoods	306	—	—	—	—	56	11	—	162	—	16	61	—	—
Other hardwoods	470	—	—	—	94	75	—	—	113	—	40	148	—	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	58,733	—	—	316	688	8,819	535	1	31,937	—	2,121	14,170	—	146
All species	62,295	—	—	316	690	9,238	563	11	33,020	—	2,150	16,161	—	146

Table 36.— *Net annual growth of sawtimber on commercial forest land by species and ownership class, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All owners	Ownership class								
		Indian	Misc. federal	State	County & municipal	Forest industry	Farmer	Misc. priv.-corp.	Misc. priv.-indiv.	Misc. priv.-indiv., leased
SOFTWOODS:										
White pine	2,560	—	—	–322	65	—	2,610	9	198	—
Red pine	1,064	—	10	234	77	—	578	—	165	—
Jack pine	981	—	—	–280	—	4	496	—	761	—
White spruce	347	—	—	170	—	—	87	—	90	—
Black spruce	10	—	—	3	—	—	7	—	—	—
Balsam fir	864	—	—	41	—	—	197	—	626	—
Tamarack	2,743	—	—	196	—	—	–200	21	2,726	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—
Other softwoods	71	—	—	—	—	—	53	1	17	—
Total	8,640	—	10	42	142	4	3,828	31	4,583	—
HARDWOODS:										
Select white oaks	16,546	—	—	588	33	—	14,607	827	478	13
Select red oaks	38,201	46	131	4,026	434	—	26,735	–714	7,543	—
Other red oaks	909	—	31	53	—	—	800	—	25	—
Hickory	1,456	—	16	8	7	—	1,401	—	24	—
Yellow birch	18	—	—	10	8	—	—	—	—	—
Hard maple	19,508	28	89	1,416	797	—	15,818	26	1,334	—
Soft maple	10,481	—	1,487	148	14	—	5,948	39	2,845	—
Ash	5,078	—	2,403	373	1,317	—	177	131	677	—
Balsam poplar	812	—	—	23	—	—	669	—	120	—
Paper birch	3,715	—	—	905	37	—	1,834	51	888	—
Bigtooth aspen	–665	21	—	402	149	—	–1,054	24	–207	—
Quaking aspen	34,262	49	597	9,270	1,187	—	6,348	3,314	13,497	—
Basswood	27,208	145	78	2,760	418	—	16,359	1,987	5,276	185
Elm	34,852	—	95	4,218	404	—	23,159	723	5,783	470
Select hardwoods	1,564	—	—	251	—	—	1,231	24	58	—
Other hardwoods	3,358	—	369	138	—	—	2,702	73	76	—
Noncommercial species	—	—	—	—	—	—	—	—	—	—
Total	197,303	289	5,296	24,589	4,805	—	116,734	6,505	38,417	668
All species	205,943	289	5,306	24,631	4,947	4	120,562	6,536	43,000	668

[1]International ¼-inch rule.

Table 37.— *Net annual growth of growing stock on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1977*

(In thousand cubic feet)

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:																
White pine	453	7	—	224	13	—	6	—	5	48	9	101	–6	46	—	—
Red pine	1,113	76	810	25	—	—	—	—	—	64	—	—	119	19	—	—
Jackpine	649	671	25	—	—	—	—	—	—	1	—	—	–56	8	—	—
White spruce	126	—	—	—	17	—	—	—	9	7	27	9	47	3	7	—
Black spruce	211	—	—	—	30	—	113	—	29	—	2	1	30	6	—	—
Balsam fir	402	10	—	—	99	—	22	—	10	—	35	26	144	56	—	—
Tamarack	508	—	8	—	24	—	63	—	709	—	–192	93	–261	44	8	12
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	100	—	25	—	—	—	—	—	—	45	—	23	1	6	—	—
Total	3,562	764	868	249	183	—	204	—	762	165	–119	253	18	188	15	12
HARDWOODS:																
Select white oaks	4,294	1	—	9	—	—	—	—	—	2,663	53	748	750	62	4	4
Select red oaks	9,025	—	12	12	—	—	3	—	6	5,643	327	1,253	1,557	208	4	—
Other red oaks	214	—	—	—	—	—	—	—	—	162	4	33	12	—	3	—
Hickory	429	—	—	—	—	—	—	—	—	346	—	69	—	14	—	—
Yellow birch	3	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—
Hard maple	4,335	—	—	—	—	—	—	—	—	341	67	3,549	362	16	—	—
Soft maple	2,940	—	—	2	3	—	—	—	7	141	629	668	1,390	100	—	—
Ash	1,538	—	—	11	—	—	2	—	1	152	581	496	241	41	8	5
Balsam poplar	833	—	—	—	—	—	—	—	7	33	—	63	410	22	298	—
Paper birch	3,761	4	6	8	4	—	9	—	—	928	24	549	1,489	731	3	6
Bigtooth aspen	332	—	—	—	—	—	3	—	—	192	—	–240	665	–289	1	—
Quaking aspen	11,430	60	53	2	14	—	32	—	23	624	–12	646	9,501	443	18	26
Basswood	8,516	—	—	—	3	—	—	—	—	1,254	141	5,477	1,525	116	—	—
Elm	10,307	—	—	—	—	—	—	—	43	1,655	846	6,236	1,243	201	53	30
Select hardwoods	306	—	—	—	—	—	—	—	—	71	14	138	68	9	3	3
Other hardwoods	470	—	—	—	—	—	—	—	—	108	282	32	42	—	—	6
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	58,733	65	71	44	24	—	49	—	87	14,313	2,959	19,717	19,255	1,674	395	80
All species	62,295	829	939	293	207	—	253	—	849	14,478	2,840	19,970	19,273	1,862	410	92

Table 38.— *Net annual growth of sawtimber on commercial forest land by species and forest type, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-cottonwood	Maple-basswood	Aspen	Paper birch	Balsam poplar	Non-stocked
SOFTWOODS:																
White pine	2,560	15	—	1,695	70	—	16	—	13	246	21	462	-175	197	—	—
Red pine	1,064	97	187	120	—	—	—	—	—	207	—	—	358	95	—	—
Jack pine	981	846	37	—	—	—	—	—	—	3	—	—	80	15	—	—
White spruce	347	—	—	—	63	—	—	—	—	—	9	22	212	14	27	—
Black spruce	10	—	—	—	3	—	—	—	—	—	—	—	7	—	—	—
Balsam fir	864	22	—	—	146	—	—	—	—	—	18	36	614	28	—	—
Tamarack	2,743	—	—	—	22	—	1,419	—	1,912	—	52	151	-1,845	1,003	29	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other	71	—	—	—	—	—	—	—	—	46	—	25	—	—	—	—
Total	8,640	980	224	1,815	304	—	1,435	—	1,925	502	100	696	-749	1,352	56	—
HARDWOODS:																
Select white oaks	16,546	—	—	13	—	—	—	—	—	10,915	203	4,213	954	218	23	7
Select red oaks	38,201	—	—	62	—	—	—	—	34	26,880	13	4,431	5,467	1,290	24	—
Other red oaks	909	—	—	—	—	—	—	—	—	678	23	161	30	—	17	—
Hickory	1,456	—	—	—	—	—	—	—	—	457	—	943	—	56	—	—
Yellow birch	18	—	—	—	—	—	—	—	—	—	18	—	—	—	—	—
Hard maple	19,508	—	—	—	—	—	—	—	—	720	174	18,039	575	—	—	—
Soft maple	10,481	—	—	6	—	—	—	—	—	1,949	2,275	884	5,339	28	—	—
Ash	5,078	—	—	9	—	—	—	—	—	191	3,213	1,397	216	31	10	11
Balsam poplar	812	—	—	—	—	—	—	—	—	79	—	135	370	20	208	—
Paper birch	3,715	—	—	17	—	—	—	—	—	525	497	335	1,111	1,230	—	—
Bigtooth aspen	-665	—	—	—	—	—	—	—	—	326	—	-1,462	1,985	-1,514	—	—
Quaking aspen	34,262	—	72	15	—	—	18	—	—	2,783	-452	781	30,081	909	22	33
Basswood	27,208	—	—	—	16	—	—	—	—	4,175	413	21,091	1,377	136	—	—
Elm	34,852	—	—	—	—	—	—	—	—	2,625	2,170	20,986	7,803	1,032	161	75
Select hardwoods	1,564	—	—	—	—	—	—	—	—	1,056	—	411	64	33	—	—
Other hardwoods	3,358	—	—	—	—	—	—	—	—	116	1,847	1,341	36	—	—	18
Noncommercial species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	197,303	—	72	122	16	—	18	—	34	53,475	10,394	73,686	55,408	3,469	465	144
All species	205,943	980	296	1,937	320	—	1,453	—	1,959	53,977	10,494	74,382	54,659	4,821	521	144

[1]International ¼-inch rule.

Table 39.— *Net annual growth of growing stock on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140
Jack pine	829	—	—	229	457	110	—	33	—	—	—	—	—
Red pine	939	—	682	110	—	66	—	—	—	81	—	—	—
White pine	293	—	—	—	—	—	128	125	40	—	—	—	—
Balsam fir	207	—	17	—	—	174	16	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	253	—	5	88	7	12	92	49	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	549	—	79	25	20	258	150	72	21	66	47	66	45
Oak-hickory	14,478	76	219	–81	1,149	3,288	2,384	2,768	1,664	366	1,621	893	131
Elm-ash-cottonwood	2,840	9	203	121	399	948	314	461	–36	109	241	26	45
Maple-basswood	19,970	284	274	796	1,957	2,812	3,111	3,588	3,150	1,733	891	1,176	198
Aspen	19,273	–1,828	1,111	1,509	6,513	6,997	3,438	988	474	71	—	—	—
Paper birch	1,862	6	48	100	503	754	155	–22	185	127	—	6	—
Balsam poplar	410	4	7	—	—	205	144	—	—	50	—	—	—
Nonstocked	92	84	5	—	—	1	—	—	2	—	—	—	—
All types	62,295	–1,365	2,650	2,897	11,005	15,625	9,932	8,062	5,500	2,603	2,800	2,167	419

Table 40.— *Net annual growth of sawtimber on commercial forest land by forest type and stand-age class, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Forest type	All classes	Stand-age class (years)											
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140
Jack pine	980	—	—	72	661	147	—	100	—	—	—	—	—
Red pine	296	—	—	22	—	68	—	—	—	206	—	—	—
White pine	1,937	—	—	—	—	—	1,284	503	150	—	—	—	—
Balsam fir	320	—	—	—	—	274	46	—	—	—	—	—	—
White spruce	—	—	—	—	—	—	—	—	—	—	—	—	—
Black spruce	1,453	—	—	581	—	—	872	—	—	—	—	—	—
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—
Tamarack	1,959	—	59	—	12	120	1,232	136	21	107	144	94	34
Oak-hickory	53,977	185	523	64	1,184	7,064	6,563	13,505	10,151	931	9,039	4,217	551
Elm-ash-cottonwood	10,494	–409	272	971	1,274	3,418	530	2,528	862	275	553	61	159
Maple-basswood	74,382	1,935	1,528	600	8,227	6,216	14,070	8,409	13,999	8,620	4,125	5,796	857
Aspen	54,659	–54	4,587	3,456	11,388	16,274	8,367	7,572	2,910	159	—	—	—
Paper birch	4,821	22	33	33	2,758	2,085	–518	–677	400	674	—	11	—
Balsam poplar	521	23	27	—	—	227	215	—	—	29	—	—	—
Nonstocked	144	121	—	—	—	7	—	—	16	—	—	—	—
All types	205,943	1,823	7,029	5,799	25,504	35,900	32,661	32,076	28,509	11,001	13,861	10,179	1,601

[1]International ¼-inch rule.

Table 41.—*Timber removals from growing stock and sawtimber on commercial forest land by species, Central Hardwood Unit, Minnesota, 1962 and 1976*

Species	Growing stock		Sawtimber	
	1962	1976	1962	1976
	Thousand cubic feet		*Thousand board feet*[1]	
SOFTWOODS:				
White pine	274	186	1,314	523
Red pine	151	132	636	405
Jack pine	411	484	1,039	1,296
Spruce	102	41	317	58
Balsam fir	133	119	192	108
Tamarack	590	304	758	318
Northern white-cedar	—	1	—	8
Other softwoods	43	72	30	50
Total	1,704	1,339	4,286	2,766
HARDWOODS:				
White oak	3,302	3,136	8,802	7,494
Red oak	5,126	7,554	17,218	21,036
Yellow birch	35	5	62	10
Hard maple	598	813	1,654	2,103
Soft maple	1,077	2,356	3,256	4,971
Ash	1,332	2,893	3,065	4,861
Paper birch	444	1,265	426	1,012
Aspen	2,876	5,542	5,289	14,560
Basswood	1,904	2,000	8,476	5,353
Elm	2,876	4,620	9,583	11,371
Other hardwoods	1,373	2,674	4,455	6,465
Total	20,943	32,858	62,286	79,236
All species	22,647	34,197	66,572	82,002

[1]International ¼-inch rule.

Table 42.— *Growing-stock removals on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	186	3	1	1	1	4	3	8	2	1	3	3	12	1	12
Red pine	132	3	3	—	—	1	1	3	4	—	3	1	1	—	2
Jack pine	484	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	20	—	—	—	—	—	—	—	—	—	—	—	3	—	1
Black spruce	21	—	—	—	—	—	3	—	—	—	—	1	—	—	1
Balsam fir	119	6	—	3	3	10	2	1	1	1	—	4	7	1	10
Tamarack	304	15	—	7	12	29	9	1	1	7	1	14	19	5	27
Northern white-cedar	1	1	—	—	—	—	—	2	—	—	—	—	—	—	—
Other softwoods	72	2	—	—	—	3	1	3	1	3	1	4	—	4	
Total	1,339	30	4	11	16	47	19	15	11	10	10	24	46	7	57
HARDWOODS:															
Select white oak	3,136	126	94	20	22	55	81	291	88	57	244	71	111	24	119
Select red oak	7,255	223	169	25	41	121	123	699	272	90	1,052	117	265	60	367
Other red oak	299	10	12	5	2	3	4	36	12	2	53	3	6	2	4
Hickory	182	9	9	—	—	3	2	12	9	2	28	3	4	1	3
Yellow birch	5	—	—	—	—	—	—	—	—	—	—	—	1	—	1
Hard maple	813	7	3	15	4	7	6	56	12	3	10	6	86	24	83
Soft maple	2,356	162	8	230	122	121	25	77	56	89	55	60	69	81	74
Ash	2,893	124	21	102	94	162	99	146	56	44	51	108	200	55	221
Balsam poplar	207	1	2	—	2	—	3	49	1	—	50	2	5	—	6
Paper birch	1,265	18	28	1	16	11	30	11	15	7	29	22	71	2	91
Bigtooth aspen	577	4	8	—	2	1	3	2	3	3	11	3	39	1	193
Quaking aspen	4,965	25	34	4	21	18	32	38	17	7	33	29	352	3	1,635
Basswood	2,000	24	13	14	8	21	17	102	60	11	58	14	192	34	230
Elm	4,620	168	36	148	85	166	65	315	136	137	218	98	282	93	369
Cottonwood	199	2	—	—	—	—	—	12	30	—	16	—	44	11	20
Black walnut	54	—	—	—	—	—	—	2	10	—	13	—	—	2	—
Other hardwoods	2,032	138	9	163	109	51	55	185	34	65	53	73	49	46	44
Total	32,858	1,041	446	727	528	740	545	2,033	811	517	1,974	609	1,776	439	3,460
All species	34,197	1,071	450	738	544	787	564	2,048	822	527	1,984	633	1,822	446	3,517

(Table 42 continued on next page)

(Table 42 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	23	1	18	65	—	1	1	—	1	6	3	1	5	6
Red pine	19	2	8	48	—	—	—	1	3	22	3	—	1	3
Jack pine	144	—	96	156	—	—	—	—	—	88	—	—	—	—
White spruce	—	—	4	11	—	1	—	—	—	—	—	—	—	—
Black spruce	1	—	4	9	—	—	—	—	1	1	—	—	—	—
Balsam fir	6	1	15	32	—	1	3	—	1	4	—	4	—	3
Tamarack	25	3	37	38	—	6	9	2	3	15	1	13	1	4
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods		1	7	4	—	1	—	2	3	6	3	—	2	6
Total	231	8	189	363	—	10	13	5	12	142	10	18	9	22
HARDWOODS:														
Select white oak	333	83	208	150	—	26	11	65	199	216	102	6	231	103
Select red oak	667	148	416	329	—	55	32	149	373	367	272	16	599	208
Other red oak	27	17	3	2	—	2	4	7	26	8	11	—	31	7
Hickory	27	3	3	1	—	2	—	6	19	7	8	—	12	9
Yellow birch	1	—	1	1	—	—	—	—	—	—	—	—	—	—
Hard maple	28	8	135	179	—	38	13	2	12	31	4	3	9	29
Soft maple	104	42	46	76	—	194	256	10	30	43	20	185	103	18
Ash	223	82	200	184	—	84	113	23	90	132	29	96	99	55
Balsam poplar	7	—	23	37	—	1	—	2	8	5	1	—	—	2
Paper birch	92	7	200	388	—	9	3	20	70	65	13	2	17	27
Bigtooth aspen	66	1	56	129	—	1	—	4	18	14	4	—	5	6
Quaking aspen	526	18	461	1,410	—	8	4	18	73	95	29	4	26	45
Basswood	109	31	305	358	—	60	13	9	64	85	26	7	50	85
Elm	280	126	353	356	—	178	139	41	155	172	70	108	189	137
Cottonwood	—	11	—	—	—	6	—	—	4	—	12	—	29	2
Black walnut	—	1	—	—	—	3	—	—	—	—	1	—	22	—
Other hardwoods	161	108	20	17	—	135	177	7	32	33	19	125	103	21
Total	2,651	686	2,430	3,617	—	802	765	363	1,173	1,273	621	552	1,525	754
All species	2,882	694	2,619	3,980	—	812	778	368	1,185	1,415	631	570	1,534	776

Table 43.— *Timber removals from sawtimber on commercial forest land by species and county, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All counties	Anoka	Benton	Carver	Chisago	Dakota	Douglas	Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	Le Sueur	Mille Lacs
SOFTWOODS:															
White pine	523	7	3	2	2	10	7	20	3	2	9	7	30	2	41
Red pine	405	5	9	—	—	1	2	5	6	—	5	1	2	—	3
Jack pine	1,296	—	—	—	—	—	—	—	—	—	—	—	—	—	—
White spruce	54	—	—	—	—	—	—	—	—	—	—	—	6	—	2
Black spruce	4	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Balsam fir	108	5	—	2	2	8	1	1	1	1	—	3	5	1	8
Tamarack	318	15	—	7	12	28	8	1	1	7	1	15	19	5	34
Northern white-cedar	8	5	1	—	—	—	—	2	—	—	—	—	—	—	—
Other softwoods	50	1	—	—	—	2	1	1	2	1	2	1	3	—	3
Total	2,766	38	13	11	16	49	20	30	13	11	17	27	65	8	91
HARDWOODS:															
Select white oak	7,494	222	191	84	48	90	131	1,198	186	94	814	146	199	68	235
Select red oak	20,026	437	352	41	92	217	210	3,074	703	168	4,203	229	564	162	792
Other red oak	1,010	24	29	11	5	6	9	171	37	5	242	8	16	5	11
Hickory	252	9	9	—	—	4	2	37	10	2	60	3	4	2	3
Yellow birch	10	—	—	—	—	—	—	—	—	—	—	—	2	—	3
Hard maple	2,103	13	7	71	9	25	11	276	53	5	37	10	169	125	205
Soft maple	4,971	319	17	452	244	238	50	159	199	175	134	119	151	189	172
Ash	4,861	190	31	186	144	241	146	304	129	64	84	160	313	113	403
Balsam poplar	603	1	3	—	3	—	4	240	1	—	241	3	4	—	6
Paper birch	1,012	12	25	1	18	6	32	8	8	3	23	22	59	1	88
Bigtooth aspen	1,852	6	16	—	6	1	5	3	3	3	25	4	161	1	1,037
Quaking aspen	12,708	35	69	3	38	15	36	41	14	6	68	32	1,249	4	6,846
Basswood	5,353	47	28	51	18	38	30	442	257	21	202	27	426	147	719
Elm	11,371	333	73	332	172	299	118	1,061	419	434	710	217	619	260	1,184
Select hardwoods	1,048	15	3	—	—	1	—	58	159	—	81	—	222	58	100
Other hardwoods	298	—	—	—	—	—	—	11	53	—	72	—	—	13	—
Noncommercial species	4,264	286	18	338	225	106	112	385	96	135	128	150	102	96	91
Total	79,236	1,949	871	1,570	1,022	1,287	896	7,468	2,327	1,115	7,124	1,130	4,260	1,244	11,895
All species	82,002	1,987	884	1,581	1,038	1,336	916	7,498	2,340	1,126	7,141	1,157	4,325	1,252	11,986

[1]International ¼-inch rule.

(Table 43 continued on next page)

(Table 43 continued)

Species	Morrison	Olmsted	Otter Tail	Pine	Ramsey	Rice	Scott	Sherburne	Stearns	Todd	Wabasha	Washington	Winona	Wright
SOFTWOODS:														
White pine	86	3	48	186	—	2	2	—	2	15	8	2	11	13
Red pine	65	3	16	160	—	—	—	1	5	104	5	—	2	5
Jack pine	403	—	239	390	—	—	—	—	—	264	—	—	—	—
White spruce	—	—	15	26	—	2	—	—	3	—	—	—	—	—
Black spruce	—	—	1	2	—	—	—	—	—	—	—	—	—	—
Balsam fir	5	1	11	41	—	1	2	—	1	3	—	3	—	2
Tamarack	24	3	43	41	—	6	9	2	2	16	1	13	1	4
Northern white-cedar	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other softwoods	9	1	5	3	—	1	—	1	2	4	2	—	1	4
Total	592	11	378	849	—	12	13	4	15	406	16	18	15	28
HARDWOODS:														
Select white oak	572	187	439	247	—	62	35	123	368	421	263	10	889	172
Select red oak	1,215	430	938	621	—	134	87	315	712	770	829	24	2,332	375
Other red oak	62	47	11	3	—	4	10	18	59	20	43	—	137	17
Hickory	27	4	3	1	—	3	—	6	19	7	11	—	16	10
Yellow birch	1	—	2	1	—	—	—	—	—	1	—	—	—	—
Hard maple	59	28	271	324	—	115	61	3	32	66	23	5	44	56
Soft maple	208	93	88	150	—	394	515	39	66	93	70	364	238	35
Ash	340	136	351	270	—	140	203	45	197	235	50	141	162	83
Balsam poplar	8	—	23	33	—	1	—	3	20	7	1	—	—	1
Paper birch	73	5	173	238	—	5	2	21	74	70	13	2	15	15
Bigtooth aspen	141	1	111	226	—	1	—	6	39	27	9	—	7	13
Quaking aspen	1,084	15	733	1,925	—	7	3	20	144	145	66	3	29	78
Basswood	276	111	718	653	—	153	41	17	242	214	89	13	191	182
Elm	562	285	837	658	—	386	252	112	483	441	173	193	506	252
Select hardwoods	—	63	—	—	—	36	—	—	16	—	71	—	152	13
Other hardwoods	—	6	—	—	—	20	—	—	—	—	6	—	117	—
Noncommercial species	331	230	39	33	—	284	368	13	64	67	39	260	224	44
Total	4,959	1,641	4,737	5,383	—	1,745	1,577	741	2,535	2,584	1,756	1,015	5,059	1,346
All species	5,551	1,652	5,115	6,232	—	1,757	1,590	745	2,550	2,990	1,772	1,033	5,074	1,374

Table 44.— *Timber removals from growing stock and sawtimber on commercial forest land by item and species group, Central Hardwood Unit, Minnesota, 1976*

Item	Growing stock						Sawtimber					
	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods	All species	Jack pine	Spruce	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet						*Thousand board feet*[1]					
Roundwood products:												
Pulpwood	2,142	260	—	8	1,566	308	4,374	523	—	19	3,643	189
Saw logs	4,775	131	3	75	537	4,029	25,511	657	13	431	2,190	22,220
Fuelwood	3,312	70	—	39	337	2,866	4,649	97	—	51	467	4,034
Posts	205	—	—	6	4	195	416	—	—	1	10	405
Veneer logs	302	—	—	—	1	301	1,973	—	—	—	5	1,968
Poles	—	—	—	—	—	—	—	—	—	—	—	—
Other[2]	1,319	—	—	—	1,156	163	7,491	—	—	—	6,485	1,006
All products	12,055	461	3	128	3,601	7,862	44,414	1277	13	502	12,800	29,822
Logging residue	893	9	—	2	132	750	2,222	3	—	4	342	1,873
Other removals	21,249	14	38	684	1,809	18,704	35,366	16	45	906	1,418	32,981
Total removals	34,197	484	41	814	5,542	27,316	82,002	1,296	58	1,412	14,560	64,676

[1]International ¼-inch rule.
[2]Includes match bolts, particleboard bolts, shavings bolts, piling, lath bolts, etc.

Table 45.— *Timber removals from growing stock by ownership class and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Ownership class	Total	Soft-woods	Hard-woods
National forest	—	—	—
Other federal	269	8	261
State	1,052	63	989
County	37	—	37
Forest industry	—	—	—
Farmer and miscellaneous private	32,839	1,268	31,571
All ownerships	34,197	1,339	32,858

Table 46.— *Timber removals from sawtimber by ownership class and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Ownership class	Total	Soft-woods	Hard-woods
National forest	—	—	—
Other federal	578	34	544
State	2,516	154	2,362
County	73	—	73
Forest industry	—	—	—
Farmer and miscellaneous private	78,835	2,578	76,257
All ownerships	82,002	2,766	79,236

[1]International ¼-inch rule.

Table 47.— *Annual mortality of growing stock on commercial forest land by species and cause, Central Hardwood Unit, Minnesota, 1976*

(In thousand cubic feet)

Species	All causes	Cause			
		Disease	Fire	Weather	Unknown and other
SOFTWOODS:					
White pine	70	—	70	—	—
Red pine	—	—	—	—	—
Jack pine	118	—	118	—	—
White spruce	—	—	—	—	—
Black spruce	—	—	—	—	—
Balsam fir	—	—	—	—	—
Tamarack	593	367	—	226	—
Northern white-cedar	—	—	—	—	—
Other softwoods	—	—	—	—	—
Total	781	367	188	226	—
HARDWOODS:					
Select white oaks	429	429	—	—	—
Select red oaks[1]	1,915	936	—	463	302
Other red oaks	—	—	—	—	—
Hickory	—	—	—	—	—
Yellow birch	—	—	—	—	—
Hard maple	—	—	—	—	—
Soft maple	—	—	—	—	—
Ash	797	—	159	638	—
Balsam poplar	—	—	—	—	—
Paper birch	—	—	—	—	—
Bigtooth aspen	1,052	711	—	341	—
Quaking aspen	6,515	1,762	2,096	2,034	623
Basswood	687	—	—	687	—
Elm	4,405	4,405	—	—	—
Select hardwoods	223	223	—	—	—
Other hardwoods	479	—	—	207	272
Noncommercial species	—	—	—	—	—
Total	16,502	8,466	2,255	4,370	1,197
All species	17,283	8,833	2,444	4,595	1,197

[1]214,000 cubic feet of select red oaks were killed by logging.

Table 48.— *Annual mortality of sawtimber stock on commercial forest land by species and cause, Central Hardwood Unit, Minnesota, 1976*

(In thousand board feet)[1]

Species	All causes	Cause			
		Disease	Fire	Weather	Unknown and other
SOFTWOODS:					
White pine	444	—	444	—	—
Red pine	—	—	—	—	—
Jack pine	286	—	286	—	—
White spruce	—	—	—	—	—
Black spruce	—	—	—	—	—
Balsam fir	—	—	—	—	—
Tamarack	1,998	1,998	—	—	—
Northern white-cedar	—	—	—	—	—
Other softwoods	—	—	—	—	—
Total	2,728	1,998	730	—	—
HARDWOODS:					
Select white oaks	1,624	1,624	—	—	—
Select red oaks	7,406	4,890	—	2,516	—
Other red oaks	—	—	—	—	—
Hickory	—	—	—	—	—
Yellow birch	—	—	—	—	—
Hard maple	—	—	—	—	—
Soft maple	—	—	—	—	—
Ash	2,740	—	—	2,740	—
Balsam poplar	—	—	—	—	—
Paper birch	—	—	—	—	—
Bigtooth aspen	3,441	1,808	—	1,633	—
Quaking aspen	15,988	5,642	2,912	5,197	2,237
Basswood	3,253	—	—	3,253	—
Elm	22,685	22,685	—	—	—
Select hardwoods	—	—	—	—	—
Other hardwoods	—	—	—	—	—
Noncommercial species	—	—	—	—	—
Total	57,137	36,649	2,912	15,339	2,237
All species	59,865	38,647	3,642	15,339	2,237

[1]International ¼-inch rule.

Table 49.— *Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1976*

Ownership class	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet*[1]		
National Forest	—	—	—	—	—	—
Bureau of Land Mgmt.	—	—	—	—	—	—
Indian	—	—	—	—	—	—
Miscellaneous federal	364	—	364	1,039	—	1,039
State	1,311	188	1,123	3,162	730	2,432
County and municipal	1,935	—	1,935	3,698	—	3,698
Forest industry	—	—	—	—	—	—
Farmer	10,829	593	10,236	40,327	1,998	38,329
Farmer-owned leased	—	—	—	—	—	—
Misc. private-corp.	454	—	454	2,425	—	2,425
Misc. private-indiv.	2,390	—	2,390	9,214	—	9,214
Misc. priv.-corp., leased	—	—	—	—	—	—
Misc. priv.-ind., leased	—	—	—	—	—	—
All owners	17,283	781	16,502	59,865	2,728	57,137

[1]International ¼-inch rule.

Table 50.— *Output of timber products by source of material and softwoods and hardwoods, Central Hardwood Unit, Minnesota, 1975*

Product and species group	Standard Unit	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*	*No. of units*	*Thousand cubic feet*
Pulpwood:	Standard								
Softwood	cords[1]	3,631	286	3,402	268	229	18	—	—
Hardwood		33,324	2,634	23,707	1,874	3,188	252	6,429	508
Total		36,955	2,920	27,109	2,142	3.417	270	6,429	508
Fuelwood:	Standard								
Softwood	cord[1]	3,949	273	1,579	109	2,013	139	357	25
Hardwood		113,239	7,828	46,367	3,203	60,843	4,203	6,029	422
Total		117,188	8,101	47,946	3,312	62,856	4,342	6,386	447
Posts:	Thousand								
Softwood	pieces	7	6	7	6	—	—	—	—
Hardwood		315	321	195	199	120	122	—	—
Total		322	327	202	205	120	122	—	—
Veneer logs:	[2]Thousand								
Softwood	board feet	—	—	—	—	—	—	—	—
Hardwood		2,076	334	1,877	302	199	32	—	—
Total		2,076	334	1,877	302	199	32	—	—
Poles:	Pieces								
Softwood		—	—	—	—	—	—	—	—
Hardwood		—	—	—	—	—	—	—	—
Total		—	—	—	—	—	—	—	—
Saw logs:	[2]Thousand								
Softwood	board feet	1,173	214	1,146	209	27	5	—	—
Hardwood		27,434	4,685	26,737	4,566	697	119	—	—
Total		28,607	4,899	27,883	4,775	724	124	—	—
Other:[3]	Thousand								
Softwood	cubic feet	9	9	—	—	—	—	9	9
Hardwood		1,953	1,953	1,319	1,319	32	32	602	602
Total		1,962	1,962	1,319	1,319	32	32	611	611
All products:	Thousand								
Softwood	cubic feet	788	788	592	592	162	162	34	34
Hardwood		17,755	17,755	11,463	11,463	4,760	4,760	1,532	1,532
Total		18,543	18,543	12,055	12,055	4,922	4,922	1,566	1,566

[1]Rough-wood, 128 cubic feet basis.
[2]International ¼-inch rule.
[3]Other (industrial production) includes match bolts, shaving bolts, particleboard bolts, lath bolts, piling, etc.

Table 51.—*Forest products harvested, by ownership class and product, Central Hardwood Unit, Minnesota, 1975*

Ownership Class	Pulpwood	Saw logs	Fuelwood	Posts	Poles	Other
	Cords[1]	*[2]Thousand board feet*	*Cords*[1]	*Thousand pieces*	*Pieces*	*Thousand cubic feet*
FEDERAL:						
National forest:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Other federal:						
Softwoods	5	33	50	—	—	—
Hardwoods	3,352	52	266	—	—	—
Total	3,357	85	316	—	—	—
STATE:						
Softwoods	515	66	26	—	—	—
Hardwoods	6,437	880	406	—	—	2
Total	6,952	946	432	—	—	2
COUNTY:						
Softwoods	—	—	—	—	—	—
Hardwoods	405	7	188	—	—	—
Total	405	7	188	—	—	—
PRIVATE:						
Forest industry:						
Softwoods	—	—	—	—	—	—
Hardwoods	—	—	—	—	—	—
Total	—	—	—	—	—	—
Farm and other:						
Softwoods	3,111	1,074	3,516	7	—	—
Hardwoods	16,701	26,495	106,350	315	—	1,683
Total	19,812	27,569	109,866	322	—	1,683
All owners:						
Softwoods	3,631	1,173	3,592	7	—	—
Hardwoods	26,895	27,434	107,210	315	—	1,685
Total	30,526	28,607	110,802	322	—	1,685

[1]Rough-wood, 128 cubic feet basis.
[2]International ¼-inch rule.

Table 52.— *Volume of primary plant residue by kind of material and type of use, Central Hardwood Unit, Minnesota, 1975*

(In thousand cubic feet)

Type of use	Total		Kind of wood residue: Coarse[1]		Fine[2]		Bark[3]	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Fiber products[4]	5.3	902.8	5.3	902.8	—	—	—	72.4
Charcoal	—	157.1	—	157.1	—	—	—	62.0
Industrial fuel	—	7.9	—	6.4	—	1.5	—	6.6
Domestic fuel	25.0	413.8	22.4	246.3	2.6	167.5	14.9	71.3
Miscellaneous[5]	9.4	445.2	.3	22.3	9.1	422.9	.2	385.4
Not used[6]	6.3	290.8	1.0	21.7	5.3	269.1	3.9	544.3
Total	46.0	2,217.6	29.0	1,356.6	17.0	861.0	19.0	1,142.0

[1]Suitable for chipping such as slabs, edgings, veneer cores, etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Does not include bark disposal at pulpmills.
[4]For manufacture of pulp, hardboard or roofing felt.
[5]Livestock bedding, mulch, small dimension, and speciality items.
[6]Includes residue burned as waste.

Table 53.— *Timber products output from roundwood by species and product, Central Hardwood Unit, Minnesota, 1975*

Species	Sawlogs		Veneer logs		Pulpwood		Fuelwood		Posts		Other Products	All Products
	Thousand board feet[1]	*Thousand cubic feet*[2]	*Thousand board feet*[1]	*Thousand cubic feet*[2]	*cords*[3]	*Thousand cubic feet*[2]	*Cords*	*Thousand cubic feet*[2]	*Thousand pieces*	*Thousand cubic feet*[2]	*Thousand cubic feet*[2]	*Thousand cubic feet*[2]
SOFTWOODS:												
White pine	127	21	—	—	—	—	200	10	—	—	—	31
Red pine	282	48	—	—	—	—	—	—	—	—	—	48
Jack pine	714	136	—	—	3,519	278	2,313	163	—	—	—	577
Spruce	14	3	—	—	—	—	—	—	—	—	—	3
Balsam fir	22	4	—	—	—	—	—	—	—	—	—	4
Tamarack	6	1	—	—	112	8	1,079	75	7	6	—	90
Northern white-cedar	8	1	—	—	—	—	—	—	—	—	—	1
Total	1,173	214	—	—	3,631	286	3,592	248	7	6	—	754
HARDWOODS:												
White oak	3,073	511	19	2	—	—	10,566	735	196	200	56	1,504
Red oak	11,514	1,931	683	110	2,818	224	39,580	2,771	108	117	10	5,163
Hickory	78	13	—	—	—	—	200	3	—	—	—	202
Yellow birch	—	—	—	—	—	—	154	7	—	—	—	7
Cottonwood	787	134	254	40	—	—	200	1	—	—	—	175
Hard maple	654	108	228	37	—	—	817	42	—	—	15	202
Soft maple	396	64	128	20	—	—	308	11	—	—	—	95
Ash	831	140	16	2	—	—	15,691	1,091	—	—	—	1,233
Balsam poplar	490	86	—	—	—	—	1,542	108	3	—	—	194
Paper birch	125	19	—	—	1,451	116	9,598	658	—	—	—	793
Aspen	2,946	543	5	1	22,626	1,786	11,131	773	8	4	1,179	4,286
Basswood	2,120	367	344	56	—	—	2,217	133	—	—	37	593
Elm	4,115	720	286	47	—	—	14,525	1,026	—	—	54	1,847
Black walnut	201	32	107	18	—	—	—	—	—	—	—	50
Other hardwoods	104	17	6	1	—	—	771	47	—	—	—	65
Total	27,434	4,685	2,076	334	26,895	2,126	107,210	7,406	315	321	1,351	16,223
All species	28,607	4,899	2,076	334	30,526	2,412	110,802	7,654	322	327	1,351	16,977

[1]International ¼-inch rule.
[2]Small quantities may round off to less than 500 cubic feet and will be shown as a dash in columns showing thousand cubic feet.
[3]Rough-wood, 128 cubic feet basis.

Table 54.— *Sampling errors[1] for estimates smaller than Unit totals of volume, net growth, and removals and of area of commercial forest land in Minnesota's Central Hardwood Unit, 1977*

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	*Thousand acres*	*Million cubic feet*			*Million board feet*		
1	4,088.7	6,805.1	724.8	2,511.8	41,179.8	1,663.7	4,861.8
2	1,022.2	1,701.3	181.2	628.0	10,294.9	415.9	1,215.4
3	454.3	756.1	80.5	279.1	4,575.5	184.9	540.2
4	255.5	425.3	45.3	157.0	2,573.7	104.0	303.9
5	163.6	272.2	29.0	100.5	1,647.2	66.5	194.5
10	40.9	68.1	7.2	25.1	411.8	16.6	48.6
15	18.2	30.2	3.2	11.2	183.0	7.4	21.6
20	10.2	17.0	1.8	6.3	102.9	4.2	12.2
25	6.5	10.9	1.2	4.0	65.9	2.7	7.8
50	1.6	2.7	0.3	1.0	16.5	0.7	1.9
100	0.4	0.7	0.1	0.3	4.1	0.2	0.5

[1]At the 68 percent probability level.

☆ U.S. Government Printing Office: 1980 669 131/41 Region No. 6

Vasilevsky, Alexander, and Ronald L. Hackett.
1980. Timber resource of Minnesota's Central Hardwood Unit, 1977. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-46, 65 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The fourth inventory of Minnesota's Central Hardwood Unit shows large gains in growing-stock and sawtimber volumes but a 17-percent decline in commercial forest area between 1962 and 1977. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

KEY WORDS: timber volume, growth, utilization, forest area.

Vasilevsky, Alexander, and Ronald L. Hackett.
1980. Timber resource of Minnesota's Central Hardwood Unit, 1977. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-46, 65 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The fourth inventory of Minnesota's Central Hardwood Unit shows large gains in growing-stock and sawtimber volumes but a 17-percent decline in commercial forest area between 1962 and 1977. This report gives statistical highlights and contains detailed tables of forest area as well as timber volume, growth, mortality, ownership, and use.

KEY WORDS: timber volume, growth, utilization, forest area.

Birds, animals and flowers are dying to tell us...no pollution, please!

L DA FOREST SERVICE
F SEARCH BULLETIN **NC-47**

GOVT. DOCUMENTS
DEPOSITORY ITEM
AUG 1 1980
CLEMSON
LIBRARY

FUELWOOD PRODUCTION IN RURAL MINNESOTA, 1975

James E. Blyth
Steven Wilhelm

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

ACKNOWLEDGMENT

Special thanks are given to the field personnel of the Resources Evaluation Project of this Station and the Minnesota Department of Natural Resources for collecting the data for this study.

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication September 27, 1979

1980

FUELWOOD PRODUCTION IN RURAL MINNESOTA, 1975

James E. Blyth, *Principal Market Analyst,*
North Central Forest Experiment Station, St. Paul, Minnesota
and **Steven Wilhelm,** *formerly Staff Forester,*
Marketing & Utilization, Minnesota Department of Natural Resources,
St. Paul, Minnesota

HISTORICAL BACKGROUND

Fuelwood was considered a minor forest product of diminishing value at the time of the Arab oil embargo in 1973. Its annual production had been declining for many years. Our oil shortage during the embargo gave impetus to a search for alternate fuel sources. Fuelwood use is climbing rapidly as an alternate and supplementary fuel in homes and manufacturing plants.

During 1975, fuelwood production in rural Minnesota was 343,000 cords including 302,000 cords from roundwood (bolts from trees) and 41,000 cord equivalents from residue (such as slabs, edgings, sawdust, and veneer cores) at primary wood-using plants. Comparisons of 1975 production with 1960 and 1970 estimates indicate the steep decline before the embargo and the sharp rise afterwards:

Year	Production from roundwood	From mill residue	Total
	(thousand cords)		
1960	525	82	607
1970	194	30	224
1975	302	41	343

ROUNDWOOD FUEL

Ninety-four percent of the fuelwood cut in 1975 from roundwood was hardwood. Major hardwoods used were red oak, paper birch, aspen, elm, ash, and white oak (table 1). Jack pine constituted 72 percent of the softwoods.

Three-fourths of the fuelwood was harvested in the Northern Pine and Central Hardwood Units (fig. 1). Since the Aspen-Birch Unit is sparsely populated and more than 100 miles from the Twin Cities metropolitan area, demand for fuelwood from this Unit is relatively low. Fuelwood production was low in the Prairie Unit because only 3 percent of the area is forested.

More than 90 percent of this fuelwood was probably consumed as household fuel and for recreational purposes in fireplaces and campfires.

FUEL FROM RESIDUE

One-fourth of the Minnesota primary mill wood residue generated in 1975 was consumed for fuel, nearly equally divided betweeen domestic and industrial fuel users (table 2). Coarse (chippable) residue was preferred by both industrial and domestic users, but nearly 3 out of 10 cords was fine residue burned chiefly by industry.

Although most hardwoods produce more BTU's per cord than softwoods, more softwood than hardwood residue was burned as fuel. Industrial consumption was primarily softwood while domestic use was mainly hardwood. Since industrial fuel was often

Table 1.—*Fuelwood production from roundwood by Survey Unit and species in rural Minnesota, 1975 (In standard cords, roughwood basis)*[1]

Species	Aspen-birch unit	Northern pine unit	Central hardwood unit	Prairie unit	All units
Softwoods:					
Cedar	—	42	—	572	614
Balsam fir	1,086	252	—	—	1,338
Jack pine	735	9,305	2,313	—	12,353
Red pine	183	336	—	—	519
White pine	34	126	200	—	360
Spruce	125	—	—	—	125
Tamarack	—	840	1,079	—	1,919
Total softwoods	2,163	10,901	3,592	572	17,228
Hardwoods:					
Ash	2,302	4,671	15,691	5,542	28,206
Aspen	20,022	24,601	11,131	572	56,326
Balsam poplar	—	559	1,542	—	2,101
Basswood	34	181	2,127	310	2,652
Paper birch	11,790	39,947	9,598	—	61,335
Yellow birch	—	210	154	—	364
Cottonwood	—	—	200	2,611	2,811
Elm	51	1,147	14,525	12,557	28,280
Hickory	—	210	200	—	410
Hard maple	403	5,075	817	1,525	7,820
Soft maple	—	4,201	308	1,296	5,805
Red oak	220	21,547	39,580	2,168	63,515
White oak	101	3,739	10,566	7,353	21,759
Other hardwoods	17	42	771	2,606	3,436
Total hardwoods	34,940	106,130	107,210	36,540	284,820
All species	37,103	117,031	110,802	37,112	302,048

[1]A cord of fuelwood is 128 cubic feet containing 70 cubic feet of solid wood and 58 cubic feet of bark and air space.

consumed at the mill of origin, transportation and handling costs per BTU were not a critical factor, and therefore, species composition of the fuel was not important. On the other hand, domestic users probably prefer hardwoods with a high BTU content because handling and transportation costs are significant for them.

Slightly more than half the fuelwood came from primary mills in the Aspen-Birch Unit, including all but 7 percent of the industrial fuel. Fifty-three percent of all wood residue generated in the Aspen-Birch Unit was used for fuel compared with 42 percent in the Prairie Unit, 20 percent in the Central Hardwood Unit, and 14 percent in the Northern Pine Unit. Strong pulpwood markets exist for residue in the Northern Pine and Central Hardwood Units and provide competition for fuelwood users.

ANALYSIS AND OUTLOOK

Minnesota fuelwood production from roundwood has increased substantially since 1975. However, based on a recent study in Michigan, it is unlikely that fuelwood production from primary wood-using mill residue in Minnesota can be increased significantly without taking the residue from some other market use such as pulpwood. Most primary mill residue is probably used now and opportunities are minimal for finding residue that is burned as waste or used as landfill.

Barring the unlikely prospect of discovering a cheap, plentiful, energy resource during the 1980's, fuelwood production from roundwood should continue to rise rapidly. If this happens, a unique opportunity may soon exist in Minnesota to produce

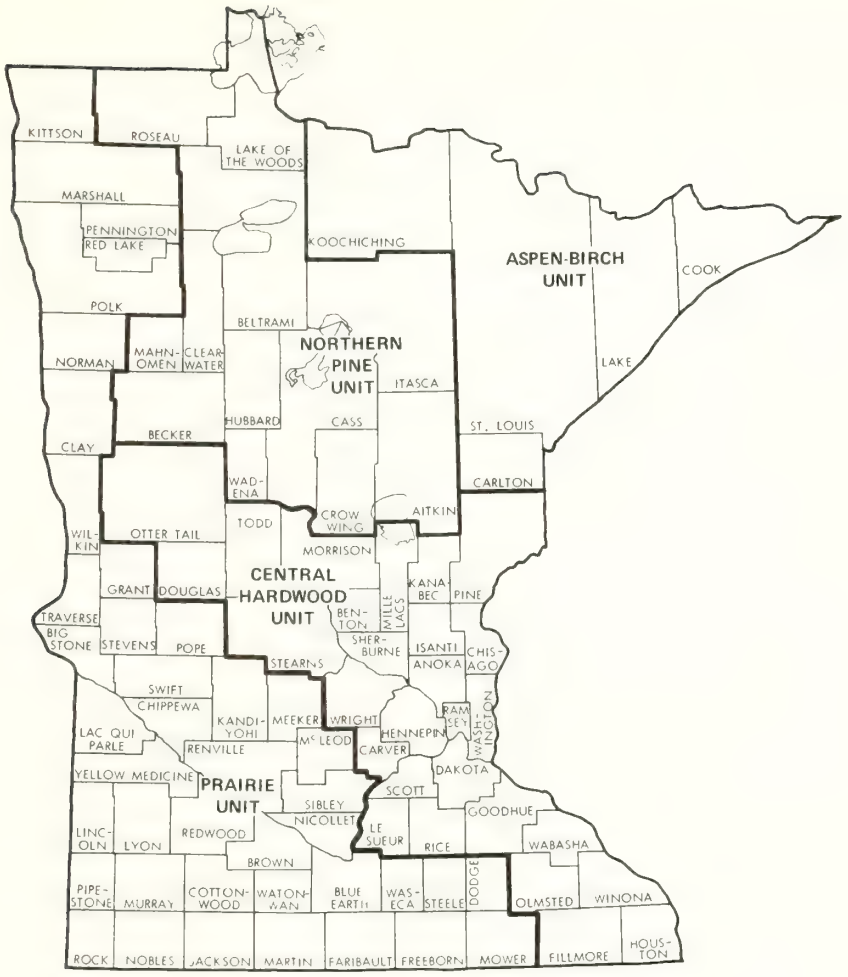


Figure 1.—*Survey Units in Minnesota.*

large quantities of joint products—fuelwood and waferboard bolts. Waferboard, a special type of particleboard, will become an important product manufactured in Minnesota. The only waferboard plant currently operating in Minnesota is doubling its capacity and construction of several other waferboard plants has been announced. Currently, waferboard mills use only specific size wafers from bolewood; tops and limbs are not used for wafers. Unit logging costs could probably be lowered by chipping the tops and limbs for fuel at the time an area is logged for waferboard bolts.

Secondary logging for fuelwood on saw log harvest areas is likely to increase. Perhaps as a cheaper alternative, fuelwood will be taken as a joint product from tops, limbs, and cull material during saw log harvesting. Less slash disposal would be necessary and site preparation costs would be reduced.

Additional timber stand improvements should be feasible with fuelwood produced from thinnings that previously were not marketable. Cull trees, dead trees, and diseased trees will become more valuable for fuel. Finally, if demand for fuelwood accelerated greatly, competition between fuelwood and pulpwood markets could become serious, driving pulpwood prices higher than anticipated.

STUDY METHODS

Roundwood Fuel

The new Rural Area Sampling Frame of the USDA Statistical Reporting Service (now part of Economics, Statistics, and Cooperative Services) was used. Using random starts in each Survey Unit, the Statistical

Table 2.—*Fuelwood production from primary wood-using mill residue by Survey Unit, type of residue, and softwoods and hardwoods, Minnesota, 1975*
(In standard cord equivalents[1])

Survey Unit and type of use	Softwood			Hardwood			All species		
	Coarse[2]	Fine[3]	Total	Coarse	Fine	Total	Coarse	Fine	Total
ASPEN-BIRCH									
Industrial fuel	11,439	7,031	18,470	283	603	886	11,722	7,634	19,356
Domestic fuel	816	27	843	1,406	77	1,483	2,222	104	2,326
Total	12,255	7,058	19,313	1,689	680	2,369	13,944	7,738	21,682
NORTHERN PINE									
Industrial fuel	—	—	—	27	1,280	1,307	27	1,280	1,307
Domestic fuel	3,918	136	4,054	5,029	67	5,096	8,947	203	9,150
Total	3,918	136	4,054	5,056	1,347	6,403	8,974	1,483	10,457
CENTRAL HARDWOOD									
Industrial fuel	—	—	—	86	28	114	86	28	114
Domestic fuel	320	37	357	3,515	2,400	5,915	3,835	2,437	6,272
Total	320	37	357	3,601	2,428	6,029	3,921	2,465	6,386
PRAIRIE									
Industrial fuel	—	—	—	—	—	—	—	—	—
Domestic fuel	14	—	14	2,214	86	2,300	2,228	86	2,314
Total	14	—	14	2,214	86	2,300	2,228	86	2,314
ALL UNITS									
Industrial fuel	11,439	7,031	18,470	396	1,911	2,307	11,835	8,942	20,777
Domestic fuel	5,068	200	5,268	12,164	2,630	14,794	17,232	2,830	20,062
Total	16,507	7,231	23,738	12,560	4,541	17,101	29,067	11,772	40,839

[1]A cord equivalent contains 70 cubic feet of solid wood.
[2]Suitable for chipping such as slabs, edgings, veneer cores, etc.
[3]Not suitable for chipping such as sawdust, veneer clippings, etc.

Table 3.—*Approximate segment size and number by Survey Unit*

Survey Unit	Open country segments		Agri-urban segments	
	Size	Number	Size	Number
	Sq. miles		*Sq. miles*	
Aspen-birch	4	100	0.1	5
Northern pine	4	102	0.1	5
Central hardwood	3	34	0.1	10
Prairie	3	31	0.1	15
Total	—	267	—	35

Reporting Service drew a systematic random sample of area segments in each Survey Unit from the open country strata and agri-urban substrata in Minnesota (table 3). No sampling was done in the urban substrata.

By using random starts, the sample was relatively evenly distributed geographically in each Survey Unit.

Thus, sampling was done on an area basis rather than by location of households. The boundaries of each sample segment were transferred to county highway maps for use by the enumerators. Roads, streams, and other readily identifiable topography were used for boundaries.

Resources Evaluation field personnel of the North Central Forest Experiment Station canvassed the sample areas in the Aspen-Birch Unit and in three counties in the Northern Pine Unit. Minnesota Department of Natural Resources personnel canvassed all other sample areas in Minnesota.

All owners of land in a sample segment were personally interviewed (using a standard questionnaire) if they lived within or adjacent to the segment. Information about fuelwood production from land held by private absentee owners was obtained from knowledgeable nearby residents. When public land was found in a segment, the administrator of that land was interviewed. From these interviews with landowners, 1975 fuelwood production was ascertained in each segment. An expansion factor was determined in each Unit by dividing the number of area segments in the Unit by the number of area segments sampled in the Unit. Fuelwood production in the Unit was estimated by multiplying the expansion factor times the fuelwood production in the sample segments in the Unit.

Fuel from Residue

All primary wood-using mills (those using logs and bolts) in Minnesota were canvassed to determine their log receipts in 1975 and how their wood and bark residue was used. Wood residue was divided into two categories—coarse wood (chippable) and fine wood (not chippable). Softwoods and hardwoods were separate categories. For each residue category, and for softwood and hardwoods separately, the percentage of residue in 1975 was determined at each mill for six types of disposal. The percentages totaled 100 for each residue and species category. Two of the types of disposal were industrial fuelwood and domestic household fuel.

Conversion factors, developed from past studies, were used to estimate the quantity of residue generated at the primary mills in 1975 based upon their log receipts. These residue quantities were then distributed by disposal category for each mill. Finally, the quantity by residue category was determined in each county. All of the calculations and summaries were processed by computer.

DEFINITION OF TERMS

Standard cord.—A pile of logs $4 \times 4 \times 8$ feet (128 cubic feet including air space and bark). A cord of fuelwood contains 70 cubic feet of wood and 58 cubic feet of bark and air space.

Primary wood-using mills.—Mills receiving roundwood or chips from roundwood.

Primary wood-using mill residue.—Wood materials (coarse and fine) and bark not utilized for principal products at manufacturing plants using roundwood. This residue includes wood products (by-products) obtained incidental to production of principal products, and wood materials not utilized for some product.

Coarse mill residue.—Wood residue suitable for chipping such as slabs, edgings, and veneer cores.

Fine mill residue.—Wood residue not suitable for chipping, such as sawdust and veneer clippings.

Roundwood.—Logs and bolts from harvested trees including chips from harvested trees.

SAMPLING ERROR

Roundwood Fuel

All the reported figures are estimates based on sampling procedures designed to give accurate estimates of fuelwood production from roundwood. A measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that the results for the sample differ, by no more than the amount indicated, from the results

that would have been obtained if all of the fuelwood cut in rural Minnesota had been determined from all the landowners.

Sampling errors for fuelwood harvested in 1975 in each Survey Unit and the State are:

Survey Unit	Quantity *(cords)*	Sampling error *(percent)*[1]
Aspen-Birch	37,103	21.9
Northern Pine	117,031	23.2
Central Hardwood	110,802	24.1
Prairie	37,112	25.5
All Units	302,048	13.3

[1] *At the 68-percent probability level.*

Fuel from Residue

Because all primary wood-using firms were canvassed to determine fuelwood production from their wood and bark residue, there is no sampling error.

STUDY LIMITATIONS

Fuelwood production was not estimated for urban Minnesota. Therefore, two components of total fuelwood production in Minnesota were excluded in this study—fuelwood harvested in urban areas and fuelwood produced from wood residue generated at secondary wood-using mills such as millwork plants, furniture plants, and office and store fixture manufacturers. Most secondary mills are located in urban areas.

☆U.S. GOVERNMENT PRINTING OFFICE: 1980--668941/2

Blyth, James E., and Steven Wilhelm.
1980. Fuelwood production in rural Minnesota, 1975. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-47, 6 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses and analyzes 1975 fuelwood production in rural Minnesota from roundwood and primary wood-using mill residue. Compares production in 1975 with production in 1960 and 1970. Assesses outlook for future fuelwood production and potential impact on Minnesota's forest industry.

KEY WORDS: Roundwood, coarse residue, fine residue, waferboard.

Blyth, James E., and Steven Wilhelm.
1980. Fuelwood production in rural Minnesota, 1975. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-47, 6 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses and analyzes 1975 fuelwood production in rural Minnesota from roundwood and primary wood-using mill residue. Compares production in 1975 with production in 1960 and 1970. Assesses outlook for future fuelwood production and potential impact on Minnesota's forest industry.

KEY WORDS: Roundwood, coarse residue, fine residue, waferboard.

Toot your hooter on pollution now!

USDA FOREST SERVICE
RESEARCH BULLETIN NC-48

GOVT PUBLICATIONS
DEPOSITORY ITEM
AUG 1 1980
CLEMSON
LIBRARY

Minnesota logging utilization factors, 1975-1976— development, use, implications

James E. Blyth and W. Brad Smith

CLEMSON UNIVERSITY LIBRARY
AUG 4 1980
SCI., TECH. & AGR. DIV.

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

North Central Forest Experiment Station
Robert A. Hann, Director
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication August 30, 1979

1980

FOREWORD

As the demand for forest products intensifies and the resulting pressure on forest resources grows, the need for accurate information on the quantity and kinds of trees required to provide these products increases.

For more than two decades, the trend has been toward using more of the harvested tree and leaving less logging residue in the woods. Total tree chipping, still in its infancy in the north-central region, was the greatest breakthrough in increasing the utilization of trees for products. In total tree chipping, all of the tree is chipped and used, except the stump, roots, and occasional branches that break off when the trees are forwarded to the chipper.

As the utilization of trees improves, fewer trees need to be harvested for a given quantity of products. Without up-to-date logging utilization factors, timber requirements for products would be overestimated and knowledge would be incomplete and inaccurate about the quantity and kinds of logging residue. In addition, the proportions of different kinds of trees harvested (such as poletimber and sawtimber) changes. Consequently, we cannot accurately project future timber stand conditions and composition without current utilization factors.

In 1975-1976, at the same time as the latest Minnesota forest inventory was conducted, we completed a study to determine Minnesota logging utilization factors for saw logs and pulpwood. New factors were needed to replace outdated factors from a study in 1960-1961. The factors were determined per thousand board feet of saw logs and per cord of pulpwood cut. This study concentrated on saw log and pulpwood factors because these products accounted for 81 percent of all Minnesota forest products harvested in 1975 and 94 percent of all products cut for forest industry.

For the first time, logging utilization factors were determined for total tree chipping as well as separate utilization factors for conventional logging. These factors are used primarily to estimate the quantity and kinds of timber cut to provide the products for a specific year.

Technical terms in this paper are defined in the Appendix.

CONTENTS

	Page
Results	1
Saw logs	1
Pulpwood—conventional logging	1
Pulpwood—total tree chipping	2
Use of results—timber harvest estimates	3
Study Limitations	5
Study Methods	5
Conventional logging	5
Total tree chipping	6
Appendix	7
Sampling error	7
Definitions	7

MINNESOTA LOGGING UTILIZATION FACTORS, 1975-1976—DEVELOPMENT, USE, IMPLICATIONS

James E. Blyth, *Principal Market Analyst,*
and **W. Brad Smith,** *Associate Mensurationist*

RESULTS

Saw Logs

Logging utilization factors for saw logs were developed for five species groups—white and red pine, other softwoods, aspen, other soft hardwoods, and hard hardwoods. For each species group, 95 percent or more of the saw log volume comes from growing stock; the remainder is from nongrowing stock such as tops and limbs of growing stock trees, cull trees, and cull logs.

For each species group, except aspen, 92 percent of the saw log volume from growing stock came from the saw log portion of sawtimber growing stock trees (table 1). Aspen saw log output is distinctly different. One-fifth comes from poletimber, an indication of the strong competition for aspen that pulpmills have experienced from sawmills.

Growing stock logging residue is four to five times higher per unit of logs produced for soft hardwoods and hard hardwoods than for aspen and softwoods. Lack of markets for mixed hardwood pulpwood in Minnesota may be the cause.

More than 50 cubic feet of nongrowing stock residue is generated per thousand board feet of "other soft hardwood" and red and white pine saw logs cut. Most of the nongrowing stock logging residue is in tops and limbs. Excluding aspen, hardwood cull trees and logs are significant sources of nongrowing stock residue.

Less logging residue is created per unit of log output in aspen than in any other species group. Well-developed markets for joint products—aspen pulpwood and saw logs—may be the key reason for the low residue production.

Per thousand board feet of log output, less growing stock (in cubic feet) is cut from white and red pine than for any other species group. This reflects the large high quality trees being harvested and good markets for pine saw logs.

Pulpwood-Conventional Logging

Pulpwood factors for conventional logging were established for four species groups—pine, other softwoods, aspen, and other hardwoods. For each species group, 88 percent or more of the conventional pulpwood comes from growing stock (table 2). On a per cord basis, more growing stock is used in softwoods than in hardwoods.

For softwoods and aspen, more than half of each cord comes from sawtimber trees; the saw log portion contributed 30 cubic feet or more per cord. Heavy use of the saw log portion indicates very competitive markets with sawmills because saw logs come primarily from the same source.

Only one-sixth of each cord from other hardwoods is from sawtimber. Because pulpwood markets are weak for other hardwoods, the pulpmills apparently can procure their requirements of other hardwoods without competing with sawmills for sawtimber. About three-fourths of the pulpwood from other hardwoods is cut from pole-timber compared to approximately one-third in other species groups.

Aspen cull trees and cull logs are an important source of pulpwood. Tops and limbs of growing stock trees are the primary source of pulpwood from nongrowing stock in other species groups.

Logging residue ranges from 10.8 cubic feet generated per cord of pulpwood in other softwoods to 16.1

Table 1.—*Volume of timber cut to provide 1,000 board feet[1] of saw logs, Minnesota, 1975-1976*
(In cubic feet)

Source of timber cut	White and red pine	Other soft-woods	Aspen	Other soft hard-woods	Hard hard-woods
Timber product output:	172.7	192.1	185.3	176.0	168.2
From growing stock:	170.4	184.6	182.0	167.8	163.4
Sawtimber trees:	168.4	178.6	145.7	157.6	162.9
Saw log portion	166.6	176.4	134.7	155.1	152.6
Upper stem	1.8	2.2	11.0	2.5	10.3
Poletimber trees	2.0	6.0	36.3	10.2	0.5
From nongrowing stock:	2.3	7.5	3.3	8.2	4.8
Tops and limbwood[2]	1.8	7.4	2.1	4.7	1.1
Cull trees and logs[3]	0.5	0.1	1.2	3.5	3.7
Saplings	0.0	0.0	0.0	0.0	0.0
Dead trees[3]	0.0	0.0	0.0	0.0	0.0
Nonforest land	0.0	0.0	0.0	0.0	0.0
Logging residue:	57.4	29.0	24.4	93.4	61.6
From growing stock:	5.2	5.4	5.7	33.6	23.8
Sawtimber trees:	5.2	5.1	4.6	33.0	23.8
Saw log portion	1.9	0.8	0.5	19.0	8.4
Upper stem	3.3	4.3	4.1	14.0	15.4
Poletimber trees	0.0	0.3	1.1	0.6	0.0
From nongrowing stock:	52.2	23.6	18.7	59.8	37.8
Tops and limbwood[4]	51.8	23.6	18.1	51.0	29.1
Cull trees and logs[5]	0.4	0.0	0.6	8.8	8.7
Saplings	0.0	0.0	0.0	0.0	0.0
Dead trees[5]	0.0	0.0	0.0	0.0	0.0
Nonforest land	0.0	0.0	0.0	0.0	0.0
Total timber cut:	230.1	221.1	209.7	269.4	229.8
From growing stock	175.6	190.0	187.7	201.4	187.2
From nongrowing stock	54.5	31.1	22.0	68.0	42.6

[1]International ¼-inch log rule.
[2]Includes tops, limbs, and stumpwood of growing stock trees.
[3]Includes tops, limbs, and stumpwood as well as bolewood.
[4]Includes tops and limbs in growing stock trees and limbs in nongrowing stock trees. Does not include stumpwood.
[5]Includes tops but not limbs.

cubic feet per cord in aspen. One-fifth or less of the residue is growing stock—most of it is tops and limbs.

For all species, less than a cord of growing stock is cut per cord of pulpwood. Pulpwood cut from nongrowing stock more than offsets the logging residue from growing stock. Aspen requires the least growing stock cut per cord of pulpwood. However, the total timber cut per cord is highest in aspen and, consequently, the most residue is created from aspen.

Pulpwood-Total Tree Chipping

Minnesota total tree chips currently are a minor source of pulpwood but will probably become more important, particularly if chips are used both for pulpwood and fuelwood. Saw logs rarely were cut and separated out during total tree chipping in Minnesota in 1976. More than 95 percent of the chips produced in Minnesota are aspen.

The major advantage of total tree chipping over conventional logging is that less growing stock is cut per cord of pulpwood. Only 61.3 cubic feet of growing stock is cut to produce a cord of total tree chips compared to 72.1 cubic feet of aspen growing stock cut per cord of conventional pulpwood. Tops, limbs, and stumpwood of growing stock trees, cull trees, and cull logs provide most of the nongrowing stock total tree chips.

Table 2.—*Volume of timber cut to provide one cord of pulpwood, Minnesota, 1975-1976*
(In cubic feet)

Source of timber cut	Conventional logging				Total tree chipping (all species)[1]
	Pine	Other soft-woods	Aspen	Other hard-woods	
Timber product output:	79.0	79.0	79.0	79.0	79.0
From growing stock:	73.6	75.2	69.2	71.8	61.3
Sawtimber trees:	46.5	48.4	41.9	13.0	27.2
Saw log portion	32.0	41.5	30.3	9.2	21.1
Upper stem	14.5	6.9	11.6	3.8	6.1
Poletimber trees	27.1	26.8	27.3	58.8	34.1
From nongrowing stock:	5.4	3.8	9.8	7.2	17.7
Tops and limbwood[2]	4.1	3.1	1.0	4.3	10.2
Cull trees and logs[3]	1.1	0.6	7.2	2.9	7.1
Saplings	0.0	0.1	0.0	0.0	0.2
Dead trees[3]	0.2	0.0	1.6	0.0	0.2
Non-forest land	0.0	0.0	0.0	0.0	0.0
Logging residue:	12.0	10.8	16.1	15.3	0.0
From growing stock:	1.1	1.3	2.9	3.1	0.0
Sawtimber trees:	0.5	0.5	1.5	0.1	0.0
Saw log portion	0.0	0.0	0.3	0.0	0.0
Upper stem	0.5	0.5	1.2	0.1	0.0
Poletimber trees	0.6	0.8	1.4	3.0	0.0
From nongrowing stock:	10.9	9.5	13.2	12.2	0.0
Tops and limbwood[4]	10.5	9.5	12.7	11.5	0.0
Cull trees and logs[5]	0.0	0.0	0.4	0.7	0.0
Saplings	0.1	0.0	0.0	0.0	0.0
Dead trees[5]	0.3	0.0	0.1	0.0	0.0
Nonforest land	0.0	0.0	0.0	0.0	0.0
Total timber cut:	91.0	89.8	95.1	94.3	79.0
From growing stock	74.7	76.5	72.1	74.9	61.3
From nongrowing stock	16.3	13.3	23.0	19.4	17.7

[1]More than 95 percent aspen.
[2]Includes tops, limbs, and stumpwood of growing stock trees.
[3]Includes tops, limbs, and stumpwood as well as bolewood.
[4]Includes tops and limbs in growing stock trees and limbs in nongrowing stock trees. Does not include stumpwood.
[5]Includes tops but not limbs.

Use of Results—Timber Harvest Estimates

The quantity of saw logs and pulpwood produced in 1975 in Minnesota was estimated from another study of primary wood-using mills (those using logs and bolts). The quantity of timber harvested (from poletimber, sawtimber, etc.) was estimated by multiplying the appropriate logging utilization factors times the estimated volume of saw logs and pulpwood produced in 1975. Based on these factors, 68.9 million cubic feet of aspen was harvested in 1975 for saw logs and pulpwood (table 3). Of this total 84 percent went into products and 16 percent was residue. Other species groups compared are pine, other softwoods, and other hardwoods.

Within these groups, striking differences are found in timber utilization on a proportional basis. More of the softwood timber cut is growing stock compared to hardwoods. The degree of tree utilization and growing stock utilization for products was highest for other softwoods followed in order by pine, aspen, and other hardwoods. More than one-fourth of the other hardwood harvest was logging residue. Sawtimber trees were a more important product source in pine than in the other species groups. More poletimber in

aspen and other softwoods is utilized compared to pine and other hardwoods. Aspen nongrowing stock was twice as important as a product source as nongrowing stock in the other groups.

For all species groups, except other hardwoods, total product output was higher than the quantity of growing stock cut. In these groups, use of nongrowing stock for products more than offset the logging residue from growing stock. Because sawmills have less competition from pulpmills for other hardwoods, timber product output from these hardwoods was 6.5 percent less than the growing stock harvest. One-third of the logging residue in other hardwoods was growing stock.

Another 309,000 cords of products could have come from logging residue in 1975. By species group, the volume was:

Species group	Logging residue (Thousand cords)
Pine	57
Other softwoods	55
Aspen	141
Other hardwoods	56

More than three-fourths of the logging residue was in tops and limbs.

Table 3.—*Volume and percent of timber cut for pulpwood and saw logs in Minnesota, 1975*

Source of timber cut	Volume				Percent			
	Pine	Other soft-woods	Aspen	Other hard-woods	Pine	Other soft-woods	Aspen	Other hard-woods
	Thousand cubic feet							
Timber product output:	25,056	31,880	57,826	12,305	84.9	87.9	83.9	73.3
From growing stock:	23,730	30,367	51,631	11,650	80.4	83.7	74.9	69.4
Sawtimber trees:	18,127	20,141	33,021	8,047	61.4	55.5	47.9	48.0
Saw log portion	15,143	17,496	25,334	7,550	51.3	48.2	36.8	45.0
Upper stem	2,984	2,645	7,687	497	10.1	7.3	11.1	3.0
Poletimber trees	5,603	10,226	18,610	3,603	19.0	28.2	27.0	21.4
From nongrowing stock:	1,326	1,513	6,195	655	4.5	4.2	9.0	3.9
Tops and limbwood[1]	1,060	1,249	718	361	3.6	3.5	1.0	2.2
Other[2]	266	264	5,477	294	0.9	0.7	8.0	1.7
Logging residue:	4,473	4,382	11,123	4,466	15.1	12.1	16.1	26.7
From growing stock:	485	543	2,070	1,506	1.6	1.5	3.0	9.0
Sawtimber trees:	357	235	1,149	1,318	1.2	0.6	1.7	7.9
Saw log portion	63	5	204	642	0.2	([3])	0.3	3.8
Upper stem	294	230	945	676	1.0	0.6	1.4	4.1
Poletimber trees	128	308	921	188	0.4	0.9	1.3	1.1
From nongrowing stock:	3,988	3,839	9,053	2,960	13.5	10.6	13.1	17.7
Tops and limbwood[4]	3,905	3,839	8,718	2,544	13.2	10.6	12.6	15.2
Other[5]	83	—	335	416	0.3	—	0.5	2.5
Total timber cut:	29,529	36,262	68,949	16,771	100.0	100.0	100.0	100.0
From growing stock	24,215	30,910	53,701	13,156	82.0	85.2	77.9	78.4
From nongrowing stock	5,314	5,352	15,248	3,615	18.0	14.8	22.1	21.6

[1]Includes tops, limbs, and stumpwood of growing stock trees.
[2]Cull trees and logs, saplings, and dead trees.
[3]Less than 0.05 percent.
[4]Includes tops and limbs in growing stock trees and limbs in nongrowing stock trees. Does not include stumpwood.
[5]Cull trees and logs, saplings, and dead trees. Includes tops but not limbs or stumpwood.

STUDY LIMITATIONS

Limbwood logging residue estimates from conventional logging and all limbwood estimates from total tree chipping depended on the accuracy of the regression equations that estimated total tree wood fiber (excluding the standard 1-foot stump). The equations provide good approximations but are being further refined and tested. Readers are cautioned to place less confidence in these limbwood data than in other measured data.

Logging residue was assigned to the major product from a tree rather than proportionally by product volume from the tree. Therefore, logging residue estimates assigned to saw logs and pulpwood vary slightly from what would have been determined by proportional allocation to joint products.

It is not practical or economical to measure utilized stumpwood or bolewood sections less than 6 inches long. Consequently, bolewood and utilized stumpwood are slightly underestimated.

STUDY METHODS

Conventional Logging

Sixty-five active logging operations were visited during 1975-1976, and 768 sample trees cut for pulpwood and saw logs were measured immediately after they were felled. The sample volume to be measured was allocated to the four Minnesota Survey Units according to the estimated annual volume of saw logs and pulpwood cut in each Unit from each species group (fig. 1). At least 1,000 cubic feet of sample was measured in each pulpwood species group and 1,100 cubic feet in each saw log species group (table 4). The sample volume included all growing stock in a sample tree plus all nongrowing stock from that tree that was used for pulpwood or saw logs. Saw log and pulpwood volumes in the sample were recorded in their respective product categories and growing stock logging residue was assigned to the major product cut from the tree. For example, if more saw log volume was cut from a tree than pulpwood, the growing stock logging residue was credited to the saw log sample requirement.

Because the degree of tree utilization can vary between public and private land, the sample proportion for each owner class in each Survey Unit was approximately the portion of commercial forest land in that owner class for that Unit.

Logging operations were found by talking to public timber sale administrators, sawmill operators,

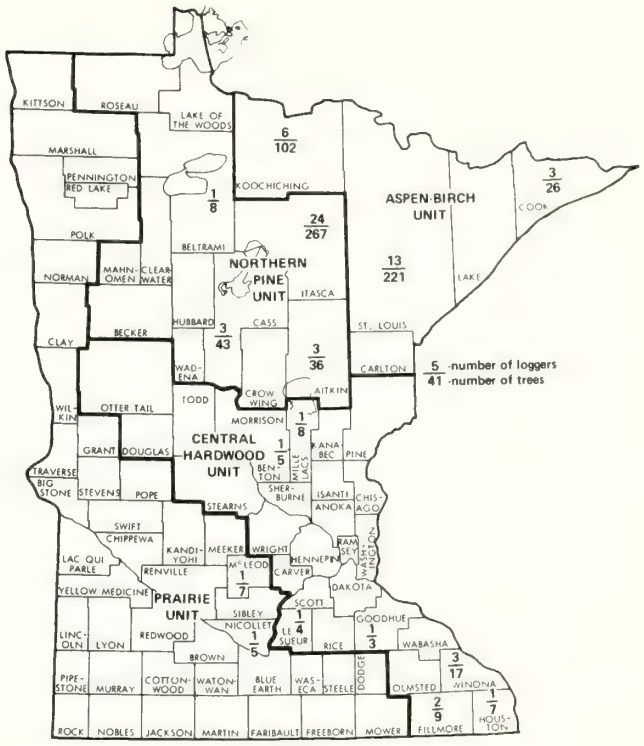


Figure 1.—*Survey Units in Minnesota and number of loggers and trees sampled during conventional logging.*

pulpwood procurement personnel, and others knowledgable about logging operations in a given area. At each logging operation, sample felled trees were measured until approximately 200 cubic feet of sample was measured or until the logging was completed, whichever occurred first. The last sample tree on an operation was completely measured even though, as a result, the sample total went above 200 cubic feet.

Large logging operations were those using feller-bunchers, or those using several fellers, and the number of felled trees generally exceeded 10 at any given time. On large operations, every fifth tree per feller was measured and the sample volume per feller was limited to approximately 200 cubic feet divided by the number of fellers.

On small logging operations, where the number of felled trees seldom exceeds 10 at any given time, all felled trees were sampled until the required volume was measured.

Each tree was classified as live merchantable (poletimber or sawtimber), sapling, cull, or dead. Tree origin was classed as commercial forest or nonforest land and the species and diameter at breast height (d.b.h.) was recorded. Each section of bolewood was classed as a product or logging residue and as

Table 4.—*Minimum volume[1] of sample felled trees to be measured by product and species group in each Survey Unit (conventional logging operations only)*
(In cubic feet)

Products	Survey Unit				State total
	Aspen-birch	Northern pine	Central hardwood	Prairie	
Saw logs:	1,120	3,870	1,960	450	7,400
White and red pine	510	1,190	—	—	1,700
Other softwoods	280	820	—	—	1,100
Aspen	200	920	80	—	1,200
Other soft hardwoods	130	510	760	300	1,700
Hard hardwoods	—	430	1,120	150	1,700
Pulpwood:	2,720	1,670	110	—	4,500
Pine	630	370	—	—	1,000
Other softwoods	660	340	—	—	1,000
Aspen	810	580	110	—	1,500
Other hardwoods	620	380	—	—	1,000

[1]Total volume is the volume of growing stock cut plus the volume of products cut from nongrowing stock.

growing stock or nongrowing stock (fig. 2). After classification, the length and diameter inside bark (at each end) of each section was measured. Limbwood used for products was similarly measured. Total wood fiber in each tree was estimated from regression equations using d.b.h. as an independent variable. Limbwood logging residue was estimated by subtracting the measured tree volume from the estimated wood fiber volume in the tree.

Total Tree Chipping

During the study period, five logging firms were producing total tree chips. A minimum of 700 cubic feet of sample was measured at each of these logger's operations with the sample for each logger equally divided among three logging sites to reduce sample bias at one site. Only the bolewood counted toward the minimum sample volume of 233 cubic feet per logging site. By county, the number of sample trees was:

County	Number of Trees
St. Louis	172
Aitkin	46
Itasca	42

Of the total sample of 260 trees, 253 were aspen.

Trees were measured after they were piled in bunches prior to delivery to the chipharvester. Not more than five trees per pile were measured, and the trees selected were those that could be moved and measured. If more than five trees could be measured in a pile, the sample trees were selected randomly (using a table of random numbers).

Sample piles were selected using a random start system so the sample was spread about equally geographically over the logging area.

Tree classification, species, and measurement data were similar to those collected in conventional logging, except no limbwood was measured and, from a practical viewpoint, no logging residue was generated. The limbwood volume used for pulpwood was estimated by subtracting total bolewood volume from the total wood fiber volume estimated by the regression equations. Occasionally saw logs were cut from trees before the remainder was chipped. These logs were included in the conventional saw log sample volume.

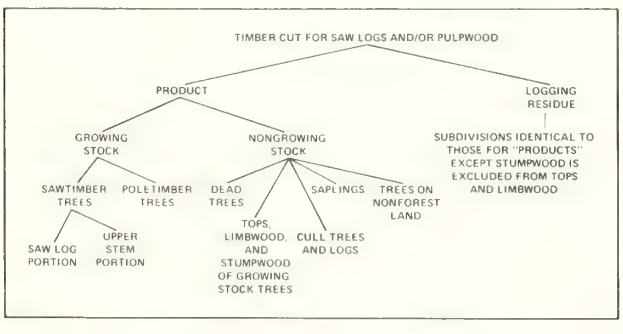


Figure 2.—*Flow chart showing potential sources of products and logging residue.*

APPENDIX

SAMPLING ERROR

All of the reported figures are estimates based on sampling procedures designed to give accurate estimates of growing stock cut in Minnesota for saw logs and pulpwood. A measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that the results for the sample differ, by no more than the amount indicated, from the results that would have been obtained if all trees in the State cut for pulpwood and saw logs had been measured.

Sampling errors for growing stock harvested per 1,000 board feet of saw logs and per cord of pulpwood cut are:

Type of logging	Sampling error (Percent)[1]
Conventional logging	
Saw logs:	
White & red pine	2.88
Other softwoods	1.68
Aspen	2.22
Other soft hardwoods	6.32
Hard hardwoods	2.57
All species	1.01
Pulpwood:	
Pine	1.89
Other softwoods	1.54
Aspen	5.27
Other hardwoods	3.59
All species	1.50
Total tree chips	
All species	4.72

For white and red pine saw logs, the growing stock cut to provide 1,000 board feet of logs is 175.6 cubic feet and has a sampling error of ± 2.88 percent (± 5.1 cubic feet). The chances are two out of three that the growing stock harvested for those logs falls between 170.5 cubic feet and 180.7 cubic feet (175.6 ± 5.1), the limits within which the results of a 100-percent sample would occur.

[1]*At the 68-percent probability level.*

DEFINITIONS

Bolewood.—Wood fiber in the central stem of a tree.

Commercial forest land.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Includes areas suitable for management to grow crops of industrial wood generally capable of producing in excess of 20 cubic feet per acre of annual growth. This includes both inaccessible and inoperable areas.

Cull trees.—Live trees that do not contain at least one merchantable 12-foot saw log or two noncontiguous 8-foot or longer saw logs, now or prospectively, because of roughness, poor form, or rot.

Growing stock.—Sawtimber and poletimber trees on commercial forest land.

Growing-stock volume.—Volume of sound wood in the bole of sawtimber and poletimber trees from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

Hard hardwoods.—Dicotyledonous species with a hardness factor of 80 or more including white ash, green ash, yellow birch, hickory, hard maple, oak, and black walnut.

Limbwood.—Volume of sound wood in limbs of trees.

Logging residue.—The unused portions of trees cut for products.

Nonforest land.—Land that has never supported forests, and land formerly forested where forest use is precluded by development for nonforest uses, such as cropland, improved pasture, residential areas, and city parks. Also includes improved roads and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land.

Nongrowing stock.—Cull trees, dead trees, saplings, cull sections of growing stock trees, limbwood, tops, stumpwood, and timber on nonforest land.

Poletimber trees.—Live trees of commercial species on commercial forest land at least 5 inches in diameter at breast height but smaller than sawtimber size, and of good form and vigor.

Saplings.—Live trees of commercial species 1 inch to 4.9 inches in diameter at breast height and of good form and vigor.

Saw-log portion.—Net volume of growing stock in the bole of sawtimber trees from a 1-foot stump to a minimum 7 inches top diameter outside bark for softwoods and 9 inches for hardwoods.

Sawtimber trees.—Live trees of commercial species on commercial forest land containing at least a 12-foot saw log or two noncontiguous saw logs, each 8 feet or longer. At least 33 percent of the gross volume of the tree must be sound wood. Softwoods must be at least 9 inches d.b.h. and hardwoods at least 11 inches.

Soft hardwoods.—Dicotyledonous species with a hardness factor less than 80 including black ash, aspen, basswood, white birch, cottonwood, elm, hackberry, soft maple, balsam poplar, and willow.

Softwoods.—Coniferous species including northern white-cedar, balsam fir, jack pine, red pine, white pine, spruce, and tamarack.

Stumpwood.—Section of a growing stock tree bole from ground level to 1 foot above ground.

Tops.—Section of a growing stock tree bole above the 4-inch minimum diameter outside bark or above the point where the central stem breaks into limbs.

Upper stem.—Section of the bole of sawtimber trees above the saw-log portion to a minimum top diameter of 4 inches outside bark or to a point where the central stem breaks into limbs.

ACKNOWLEDGMENT

Special thanks are given to the Resources Evaluation field personnel of the North Central Forest Experiment Station whose diligent efforts in locating and measuring the sample trees made these results possible.

☆U.S. GOVERNMENT PRINTING OFFICE: 1980--668905/4

Blyth, James E., and W. Brad Smith.

1979. Minnesota logging utilization factors, 1975-1976—development, use, implications. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-48, 8 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses Minnesota saw log and pulpwood logging utilization factors developed during 1975-1976 and their implications. Compares factors for several species groups and shows their use in estimating growing stock cut for pulpwood and saw logs.

KEY WORDS: Saw logs, pulpwood, growing stock, residue, total tree chips.

Blyth, James E., and W. Brad Smith.

1979. Minnesota logging utilization factors, 1975-1976—development, use, implications. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-48, 8 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses Minnesota saw log and pulpwood logging utilization factors developed during 1975-1976 and their implications. Compares factors for several species groups and shows their use in estimating growing stock cut for pulpwood and saw logs.

KEY WORDS: Saw logs, pulpwood, growing stock, residue, total tree chips.

Sing along with Woodsy and help stop pollution.

75.80:NC-49

USDA FOREST SERVICE
RESOURCE BULLETIN **NC-49**

GOVT. DOCUMENTS
DEPOSITORY ITEM

NOV 7 1980

CLEMSON
LIBRARY

CLEMSON UNIVERSITY LIBRARY
NOV 11 1980
SCI. TECH. & AGR. DIV.

Lake States

PRIMARY FOREST INDUSTRY AND TIMBER USE

1975

James E. Blyth
James H. Whipple
Allen H. Boelter
Steven Wilhelm

North Central Forest Experiment Station
Forest Service, U.S. Department of Agriculture

FOREWORD

This publication contains the results of a detailed study of forest industry and industrial roundwood production in the Lake States (Michigan, Minnesota, and Wisconsin) in 1975. Such detailed information is necessary for intelligent planning and decision-making in wood procurement, forest resource management, and forest industry development. Also, researchers need current forest industry and industrial roundwood information for planning projects.

Special thanks are given to the primary wood-using firms that supplied information for this study. Their cooperation is greatly appreciated.

Quantities shown may vary slightly from one table to another because of rounding differences, but these differences are insignificant.

Pulpwood production in Minnesota is completely and accurately shown. However, to prevent disclosure of confidential information about softwood pulpwood use by individual companies, the total quantity of softwood pulpwood imports in Minnesota from Canada and softwood exports from Minnesota to Canada are not reported. Thus, some Minnesota softwood shipped to Canada is shown as remaining and used in Minnesota and receipts of Canadian softwood in Minnesota are understated.

Veneer logs produced and shipped to a specialty veneer company in Minnesota are reported in the "miscellaneous" product or "other" product categories to prevent disclosure of confidential data about the mill.

North Central Forest Experiment Station
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication September 5, 1979
1980

LAKE STATES PRIMARY FOREST INDUSTRY AND TIMBER USE, 1975

James E. Blyth, *Principal Market Analyst,*
North Central Forest Experiment Station, St. Paul, Minnesota,
James W. Whipple, *Forest Products Specialist,*
Wisconsin Department of Natural Resources, Tomahawk, Wisconsin,
Allen H. Boelter, *formerly Staff Forester, Marketing & Utilization,*
Michigan Department of Natural Resources, Lansing, Michigan,
and **Steven Wilhelm,** *formerly Staff Forester, Marketing & Utilization,*
Minnesota Department of Natural Resources, St. Paul, Minnesota

HIGHLIGHTS

- Industrial roundwood production was 455.3 million cubic feet—two-thirds was hardwood and one-third was softwood.
- Based on commercial forest acreage owned, the public and private sectors in Minnesota and Wisconsin each contributed about their share of the harvest.
- More than half the hardwood industrial roundwood cut was aspen. Jack pine was the major softwood cut.
- Ninety-four percent of the roundwood harvest was pulpwood and saw logs.
- Lake States pulpmills use more than twice as much roundwood as Lake States sawmills.
- Roundwood accounted for 89 percent of the 4.14 million cords of pulpwood produced.
- Wisconsin pulpmills depend heavily on out-of-State pulpwood.
- Lake States loggers harvested 850 million board feet of saw logs. The major species cut were aspen, red oak, and hard maple.
- Regional sawmills imported only 1.1 million board feet of logs from other regions and Canada.
- Primary wood-using mills (except pulpmills) generated 1,156,000 green tons of coarse wood residue, 724,000 green tons of fine wood residue, and 531,000 green tons of bark.
- Markets for coarse residue were good within the region. Demand for fine wood residue and bark was satisfactory in Wisconsin and poor in Minnesota and Michigan.

ECONOMIC BACKGROUND

From an economic viewpoint, 1975 was not a good year for most United States industries including the forest industry. Our Nation was struggling to recover from a recession, unemployment was more than 8 percent, and housing starts were low. National lumber production was lower than in any year since 1961 and pulpwood production was lower than in any year since 1969. The results of this regional study should be used cautiously and with the understanding that national and regional markets for major forest products were very weak in 1975. In comparing data in this publication with similar published data for other years, the economic conditions for each year should be carefully considered.

PRIMARY FOREST INDUSTRY—INDUSTRIAL ROUNDWOOD

Industrial roundwood production in the Lake States in 1975 was 455.3 million cubic feet—37 percent from Wisconsin, 33 percent from Michigan, and 30 percent from Minnesota.

Of the 889 active primary wood-using mills in 1975 in the Lake States, 775 were sawmills. Because lumber markets were poor in 1975, between 100 and 200 small sawmills were not producing that probably would have been operating if the economy were stronger. Forty-one pulpmills used more than twice as much roundwood (including chips from roundwood) as the sawmills. Markets for high quality logs were provided by 31 veneer mills. Another 42 mills made a wide variety of products including cooperage (barrel staves), shavings, lath, particleboard, charcoal, excelsior, fencing, and other specialty products.

Major mills are concentrated in the Upper Peninsula and northern Lower Peninsula of Michigan; northern and north-central Minnesota; and northeastern Wisconsin (fig. 1).

About 68 percent of commercial forest land in Wisconsin is privately owned and provided 71 percent of Wisconsin's industrial roundwood harvest in 1975 (fig. 2). In Minnesota, 46 percent of commercial forest land is privately owned and furnished 49 percent of the industrial roundwood. Based on commercial forest acreage owned, the public and private sectors are each providing approximately their share of the harvest in Minnesota and Wisconsin. Similar harvest by owner class data were not collected in Michigan.

About two-thirds of the industrial roundwood was hardwood. More than half the hardwood was aspen; other important hardwoods were red oak and hard maple (fig. 3). Jack pine was the major softwood followed by balsam fir and spruce.

Industrial roundwood production from aspen was 32 percent in Michigan, 36 percent in Wisconsin, and 46 percent in Minnesota. Elm constituted 7 percent of the Wisconsin harvest because much elm was being salvaged from Dutch Elm Disease outbreaks. Elm was only 2 percent of Michigan's production because Dutch Elm Disease had peaked there before 1975. Demand for hard maple was high in Michigan.

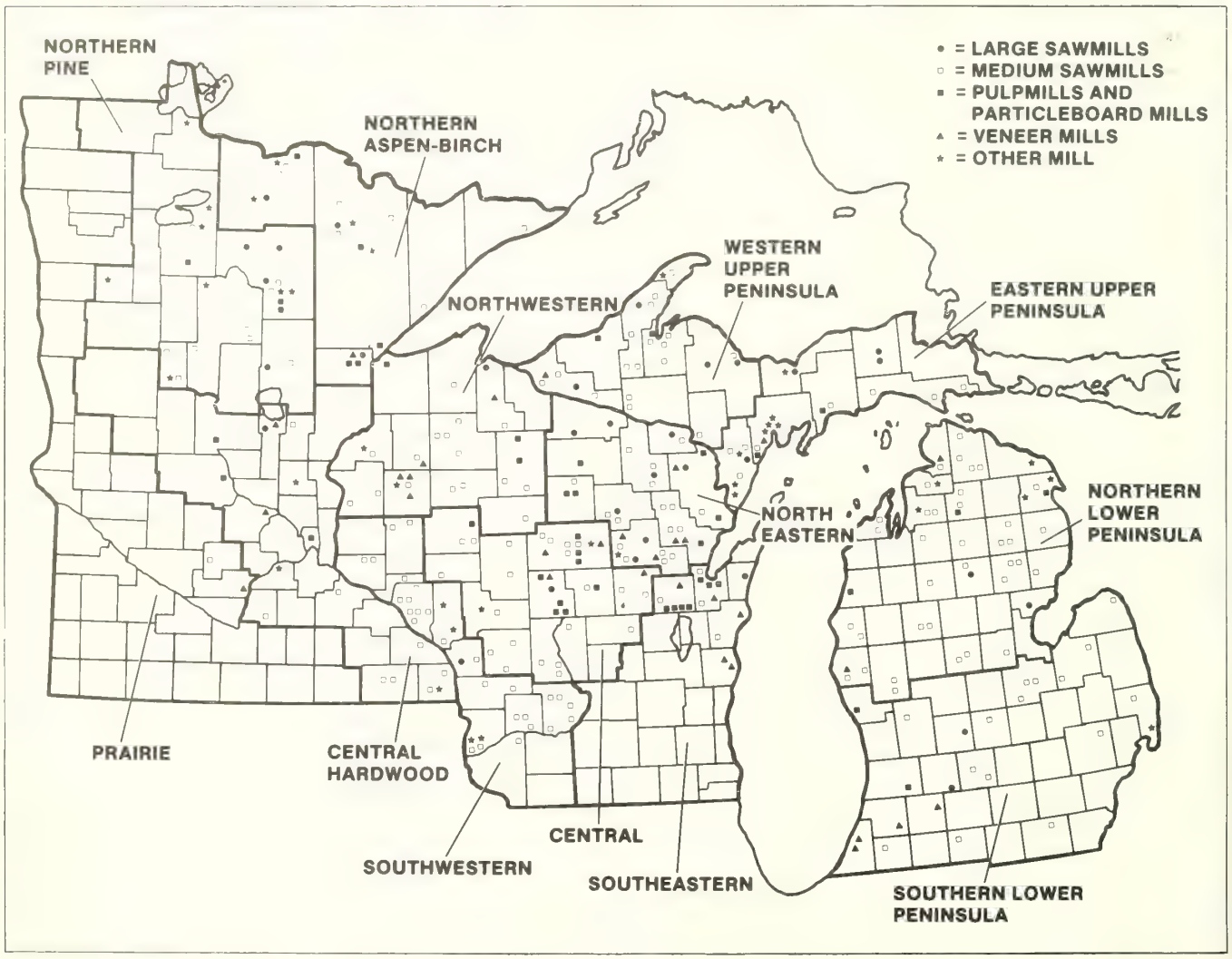


Figure 1.—*Primary wood-using mills and Forest Survey Units in the Lake States, 1975. Sawmills are classed by volume of lumber produced in 1975: large = 5 million board feet or more; medium = 1 to 4.999 million board feet (smaller sawmills not shown).*

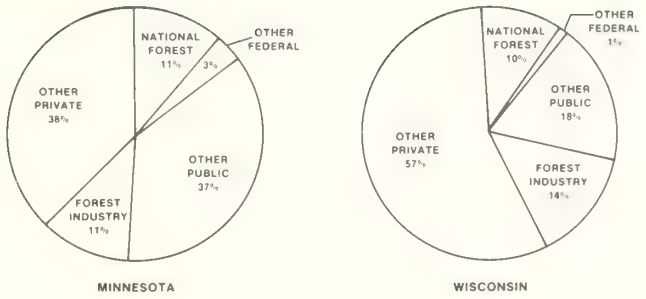


Figure 2.—*Industrial roundwood production by landowner class in Minnesota and Wisconsin, 1975.*

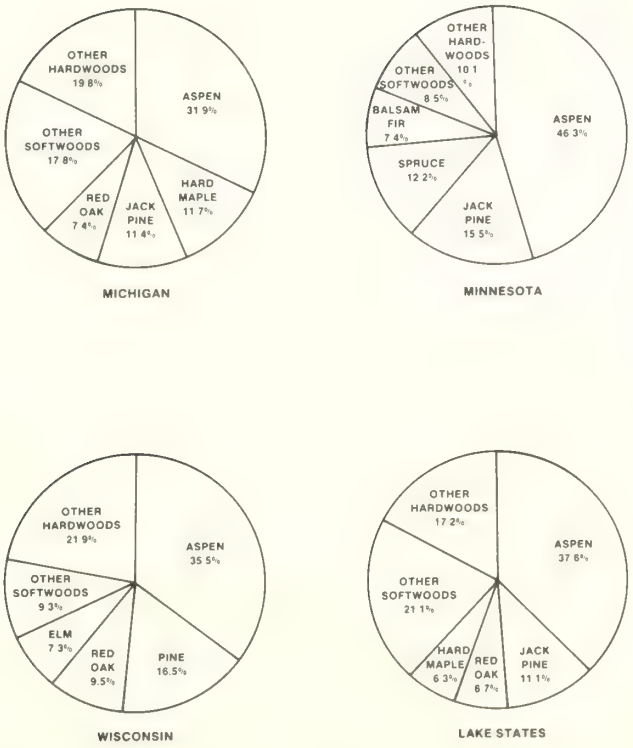


Figure 3.—*Lake States industrial roundwood production by major species, 1975.*

Softwoods are a more important harvest segment in Minnesota (44 percent) than in Michigan (29 percent) or Wisconsin (26 percent). Red and white pine were more significant components of total pine production in Wisconsin than in the other States.

Pulpwood and saw logs are the major industrial wood raw materials in the Lake States (fig. 4). Pulpwood, the dominant product in each State, was particularly important in Minnesota where it accounted for 73 percent of the industrial roundwood cut in 1975.

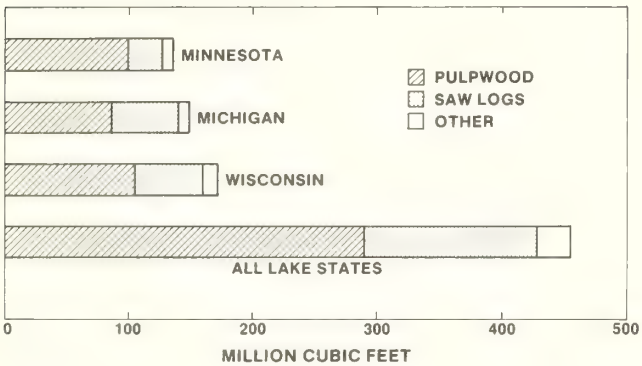


Figure 4.—*Lake States roundwood production by type of product, 1975.*

PULPWOOD

Of the 4.14 million cords of pulpwood produced in 1975, about 89 percent (3.68 million cords) was roundwood (including chips from roundwood); the remainder was wood residue from sawmills, veneer mills, and other mills. Principal species cut for pulpwood were:

Species	Volume (thousand cords)
Aspen	1,639
Jack pine	523
Balsam fir	293
Spruce	272
Paper birch	136
Red pine	123
Hard maple	112
Red oak	104

Aspen has been the major Lake States pulpwood species for more than three decades. Use of other hardwoods became significant after World War II. Harvesting of paper birch, an underutilized species, has climbed sharply since 1969.

During the late 1940's, pine, balsam fir, and spruce harvests were each about equal. Since then, pine harvesting has increased and balsam fir and spruce harvesting has decreased. In the 1970's, pine pulpwood production has been greater than the combined output of balsam fir and spruce.

Only minor amounts of wood residue from Lake States mills was used by pulpmills prior to 1959. Since then, use of wood residue from resident mills grew rapidly to 144,000 cords in 1965, then 349,000 cords in 1970, and 468,000 cords in 1975.

Compared to residue, Lake States roundwood use for pulp has grown slower (in percent) and less steadily since 1960. Residue is a highly valued substitute for roundwood at some pulpmills. Some paper companies have purchased or built sawmills that give them a captive supply of residue chips and a more diversified product mix. Sawmills, veneer mills, and pulpmills have jointly profited from rising demand for wood residue in pulp manufacturing.

Due to the closure of a Michigan pulpmill in 1975 during an employee strike, Minnesota produced more pulpwood than Michigan for the first time since 1958. Wisconsin was the top pulpwood producer.

Lake States pulpmills rely primarily on regional producers for their wood requirements. Imports in 1975 from other regions of the United States were 205,000 cords, primarily from western States. Two-thirds of these imports were softwood mill residue chips from South Dakota, Wyoming, Colorado, and Montana.

Wisconsin is heavily dependent on imported pulpwood (38 percent of their wood is from out-of-State) but Michigan is nearly self-sufficient (only 3 percent of their wood is from out-of-State). Imports were not all reported in Minnesota (see Foreword) but were probably between 5 and 15 percent of total demand.

Pulpwood exports from the region, although not fully reported, are minor.

SAW LOGS

Lake States loggers cut 850 million board feet of saw logs in 1975. Most of the output was used in the State where it was cut. Only 4 percent was shipped out-of-State and less than 1 percent was shipped outside the Lake States region.

Four-fifths of the saw log harvest was hardwood. Leading species cut were:

Species	Volume (Million board feet)[1]
Aspen	162.7
Red oak	130.2
Hard maple	124.1
Elm	70.6
White pine	62.9
Jack pine	42.0

Demand for aspen and jack pine saw logs has risen rapidly since 1960. Aspen has found widespread use in pallets, furniture, crating, and construction. Jack pine has developed market acceptance in construction.

Red oak and hard maple are important species for furniture, flooring, railroad ties, and pallets.

Elm harvesting is directly related to the spread of Dutch Elm Disease. For example, Dutch Elm was widespread in Michigan's Lower Peninsula in 1965 when 60.8 million board feet of elm saw logs were cut. In 1975 after the disease had devastated elm in the Lower Peninsula and moved into Wisconsin, the Michigan elm harvest dropped to 15.2 million board feet. The spread of the disease in Wisconsin is reflected by the increased elm harvest from 30.9 million board feet in 1967 to 45.9 million board feet in 1975. Minnesota was relatively untouched by Dutch Elm in 1975 as indicated by a saw log harvest gain of only 600,000 board feet from 1960 to 1975.

Michigan produced the largest volume of saw logs (42 percent), followed by Wisconsin (40 percent), and Minnesota (18 percent). Minnesota produces fewer saw logs because it has less hardwood timber than the other States in some high demand saw log species such as hard maple, red oak, soft maple, and white oak.

Top-producing Counties were Gogebic, Baraga, and Luce in Michigan; Shawano (includes Menominee), Forest, and Marathon in Wisconsin; and Itasca, St. Louis, and Koochiching in Minnesota.

Saw log receipts in the region were 846.6 million board feet including only 1.1 million board feet from other regions and Canada. Wisconsin, the most dependent of the Lake States on log imports, imported 25.0 million board feet of saw logs from Michigan and 3.6 million board feet from Minnesota. Loggers in Michigan's Western Upper Peninsula Unit supplied 23.7 million board feet of saw logs to Wisconsin, primarily to mills in the Northeast Unit which received 23.5 million board feet from Michigan.

Lumber production was highest in the Upper Peninsula of Michigan, northeast Wisconsin, and northeast Minnesota (fig. 5). Lumber output per sawmill has been rising throughout the region. Most new sawmills are larger than the average while those closing are usually small producers. Other mills have become more cost efficient and have developed markets for their wood residues by expanding their production capacity.

OTHER PRODUCTS

Other industrial roundwood products (6 percent of the total) cut in 1975 were posts, poles, mine timbers, and logs and bolts used for veneer, cooperage (barrel staves), excelsior, particleboard, shavings, lath, charcoal, and specialty products. Output of these products was widely scattered in the region.

One-third of the "other products" volume was veneer logs. Wisconsin supplied 52 percent, Michigan 43 percent, and Minnesota 5 percent. Principal veneer species were aspen, red oak, hard maple, elm, and yellow birch. Each State shipped one-third or more of their veneer log production out-of-State, but no State shipped more than 11 percent outside the Lake States region. Primary veneer log production areas were the Western Upper Peninsula Unit in Michigan; the Central Hardwood Unit in Minnesota; and the Northeastern, Northwestern, and Southwestern Units in Wisconsin.

Thirty Lake States veneer mills received 60.7 million board feet of logs in 1975. Only 1.9 million board feet were procured outside the Lake States.

Particleboard bolts, nearly one-fourth of the "other product" volume, were chiefly aspen. Aspen is an excellent particleboard species that was successfully used in Canada before the Lake States. Unlike southern and western particleboard, Lake States particleboard is made primarily from roundwood rather than wood residue from other mills.

Excluding veneer logs, all but minor quantities of "other products" were processed in the Lake States.

[1] *International ¼-inch rule.*

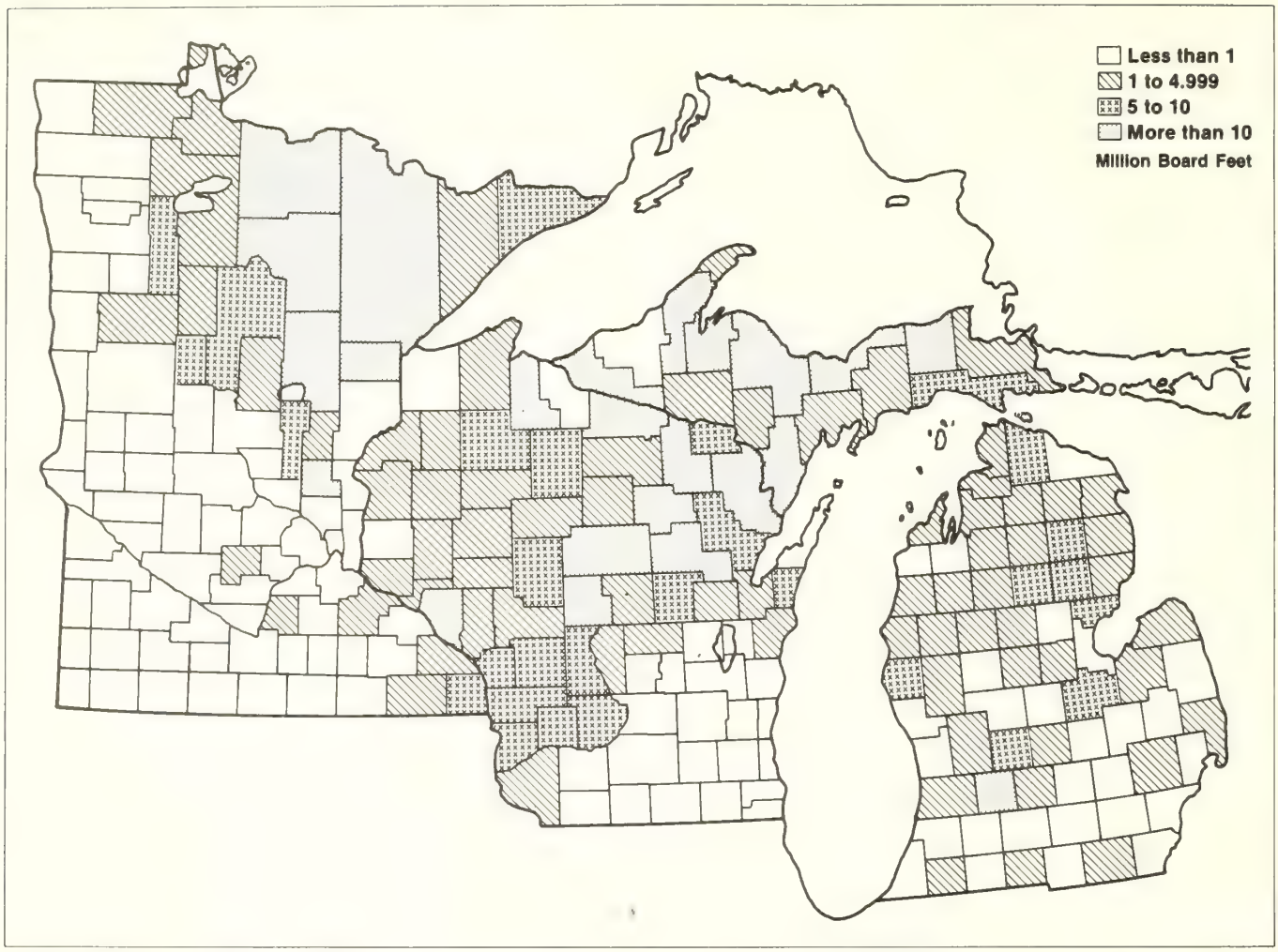


Figure 5.—*Lumber production in Lake States Counties, 1975.*

PRIMARY MILL RESIDUE

During 1975, Lake States primary wood-using mills (except pulpmills) generated approximately 1,156,000 green tons of coarse (chippable) wood residue, 724,000 green tons of fine wood residue, and 531,000 green tons of bark.

The amount of residue not used for products (piled, land fill, burned as waste, etc.) was:

Class of residue	Softwood	Hardwood
	(Percent)	
Coarse	*16*	*8*
Fine	*39*	*34*
Bark	*44*	*39*

Demand was good for coarse residue throughout the region—pulpwood was the main use. Markets for fine and bark residue were satisfactory in Wisconsin and poor in Minnesota and Michigan. Fuelwood was an important use for fine and bark residue in all States. A third of the fine hardwood residue was marketed for mulch, poultry litter, livestock bedding, and similar uses.

OUTLOOK

Markets for paper birch will improve. Large surpluses of paper birch are located throughout the Lake States, and opportunities are developing to substitute birch for other species. One potential market for paper birch is in particleboard.

Particleboard production will increase. Several new waferboard plants have recently been announced for Minnesota, and one is under construction

in Wisconsin. Waferboard is a special type of particleboard using wood wafers engineered to a specific size in place of random-sized particles. Aspen is the preferred species in the new plants. As manufacturing technology improves and the aspen supply-demand situation tightens, paper birch and other hardwoods in surplus supply will probably be used in Lake States waferboard.

Cedar, another underutilized species, doesn't appear to have many opportunities to further penetrate existing markets or enter new markets by 1985. However, technological breakthroughs in pulping cedar could drastically change this outlook.

High demand for railroad ties until 1985 or beyond is likely to strengthen the overall market for oak even during periods of economic slowdown.

Use of elm in Wisconsin is declining but will rise in Minnesota as Dutch Elm Disease spreads through the State. Most of the Minnesota diseased elm will be used for saw logs, veneer logs, and fuelwood. Pulpwood will not be a major market outlet for Minnesota elm unless out-of-State pulpmills decide to procure more.

Whole tree chips, a minor source of pulpwood in 1975, will probably increase in use slowly for the next few years. Their use may increase faster if harvesting systems are further refined to economically produce joint products—"clean" pulpwood chips and "barky" fuelwood chips.

Undoubtedly, use of bark and fine residue for fuel and other uses has climbed substantially since 1975. Finding markets for any type of wood or bark residue at primary mills is likely to be a minor problem by 1981. Use of wood and bark residue for fuel should continue to increase and may compete more vigorously with other uses of this residue as the quantity of unused residue shrinks.

APPENDIX

STUDY METHODS

Data for this publication came from a complete canvass (with formal questionnaires) of primary wood-using firms using Lake States logs and bolts and all public agencies administering forest land in Minnesota and Wisconsin. Public agencies were not canvassed in Michigan. The study was a cooperative effort between the Departments of Natural Resources (DNR's) in Michigan, Minnesota, and Wisconsin and the North Central Forest Experiment Station (NCFES). Special thanks are given to the forestry staffs of the DNR's in each State for canvassing the mills in their respective States and also to the Resources Evaluation field crews of the NCFES for personally canvassing many mills in northeastern Minnesota. The DNR's made estimates, based on past studies and knowledge, for a few mills refusing to respond or that were out of business at the time of interview.

The Minnesota and Wisconsin DNR's canvassed public agencies (other than Federal) to determine the 1975 timber products harvest on land they administer.

The NCFES canvassed out-of-State mills using Lake States roundwood and the Federal agencies. The Station edited and compiled the data.

The NCFES canvassed railroads serving Minnesota to determine for 1975 the number of cars loaded with logs at Minnesota shipping points and destined for Great Lakes or ocean ports. From these reports, the Station estimated the volume of logs exported overseas from Minnesota. Log exports overseas from Michigan and Wisconsin were not determined.

DEFINITION OF TERMS

Industrial roundwood products.—Saw logs, pulpwood, veneer logs, poles, commercial posts, piling, particleboard bolts, excelsior bolts, lath bolts, charcoal bolts, cooperage logs, shaving bolts, bolts for specialty products, and chips from roundwood.

Primary wood-using plant residue.—Wood materials (coarse and fine) and bark not utilized for principal products at manufacturing plants using

roundwood. This residue includes wood products (by-products) obtained incidental to production of principal products and wood materials not utilized for some product.

Coarse plant residue.—Wood residue suitable for chipping such as slabs, edgings, and veneer cores.

Fine plant residue.—Wood residue not suitable for chipping, such as sawdust and veneer clippings.

Production (output).—The annual quantity, determined from mill receipts, of one or a group of roundwood products cut in a specific geographic area, plus the annual wood residue quantity produced by sawmills, veneer mills, etc., in a specific geographic area that was used for the product.

Receipts.—The annual quantity of wood received by mills in a specific geographic area, regardless of the geographic source.

Primary wood-using mills.—Mills receiving roundwood or chips from roundwood.

COMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

SOFTWOODS:

Eastern white pine ..... *Pinus strobus*
Red pine ..... *Pinus resinosa*
Jack pine ..... *Pinus banksiana*

Spruce:
White spruce ..... *Picea glauca*
Black spruce ..... *Picea mariana*
Balsam fir ..... *Abies balsamea*
Eastern hemlock ..... *Tsuga canadensis*
Tamarack ..... *Larix laricina*
Northern white-cedar ..... *Thuja occidentalis*

HARDWOODS:

White oak:
White oak ..... *Quercus alba*
Bur oak ..... *Quercus macrocarpa*
Chinkapin oak ..... *Quercus muehlenbergii*
Swamp white oak ..... *Quercus bicolor*

Red oak:
Northern red oak ..... *Quercus rubra*
Black oak ..... *Quercus velutina*
Pin oak ..... *Quercus palustris*
Hickory:
Bitternut hickory ..... *Carya cordiformis*
Pignut hickory ..... *Carya glabra*
Shagbark hickory ..... *Carya ovata*

Yellow birch ..... *Betula alleghaniensis*

Hard maple:
Black maple ..... *Acer nigrum*
Sugar maple ..... *Acer saccharum*

Soft maple:
Red maple ..... *Acer rubrum*
Silver maple ..... *Acer saccharinum*
American beech ..... *Fagus grandifolia*

Ash:
Black ash ..... *Fraxinus nigra*
White ash ..... *Fraxinus americana*

Balsam poplar ..... *Populus balsamifera*

Aspen:
Bigtooth aspen ..... *Populus grandidentata*
Quaking aspen ..... *Populus tremuloides*

Eastern cottonwood ..... *Populus deltoides*

American basswood ..... *Tilia americana*
Black walnut ..... *Juglans nigra*

Elm:
American elm ..... *Ulmus americana*
Rock elm ..... *Ulmus thomasii*
Slippery elm ..... *Ulmus rubra*

Paper birch ..... *Betula papyrifera*

Table 1.—*Lake States industrial roundwood production by product and State, 1975*

ALL LAKE STATES

Product	Standard units	All species	Soft-woods	Hard-woods	All species	Soft-woods	Hard-woods
		-------Thousand standard units-------			---------Thousand cubic feet ---------		
Pulpwood	Standard cords	3,676	1,400	2,276	290,230	110,510	179,720
Saw logs	Board feet	850,045	174,076	675,969	137,985	29,730	108,255
Veneer logs[1]	Board feet	60,987	18	60,969	9,194	2	9,192
Posts[2]	Pieces	5,396	5,396	0	5,140	5,140	0
Cooperage logs	Board feet	3,284	0	3,284	451	0	451
Poles	Pieces	132	132	0	861	861	0
Miscellaneous[3]	Cubic feet	11,778	506	11,272	11,455	506	10,949
Total					455,316	146,749	308,567
			MICHIGAN				
Pulpwood	Standard cords	1,098	409	689	86,682	32,287	54,395
Saw logs	Board feet	359,236	49,905	309,331	53,921	7,554	46,367
Veneer logs	Board feet	26,079	0	26,079	3,575	0	3,575
Posts[2]	Pieces	3,083	3,083	0	3,169	3,169	0
Cooperage logs	Board feet	0	0	0	0	0	0
Poles	Pieces	21	21	0	177	177	0
Miscellaneous[3]	Cubic feet	1,256	312	944	1,256	312	944
Total					148,780	43,499	105,281
			MINNESOTA				
Pulpwood	Standard cords	1,251	578	673	98,834	45,675	53,159
Saw logs	Board feet	156,123	60,923	95,200	28,233	11,261	16,972
Veneer logs[1]	Board feet	3,216	0	3,216	503	0	503
Posts[2]	Pieces	1,752	1,752	0	1,407	1,407	0
Cooperage logs	Board feet	916	0	916	128	0	128
Poles	Pieces	103	103	0	618	618	0
Miscellaneous[3]	Cubic feet	5,990	190	5,800	5,990	190	5,800
Total					135,713	59,151	76,562
			WISCONSIN				
Pulpwood	Standard cords	1,327	413	914	104,714	32,548	72,166
Saw logs	Board feet	334,686	63,248	271,438	55,831	10,915	44,916
Veneer logs	Board feet	31,692	18	31,674	5,116	2	5,114
Posts[2]	Pieces	561	561	0	564	564	0
Cooperage logs	Board feet	2,368	0	2,368	323	0	323
Poles	Pieces	8	8	0	66	66	0
Miscellaneous[3]	Cubic feet	4,532	4	4,528	4,209	4	4,205
Total					170,823	44,099	126,724

[1]Does not include specialty veneer logs harvested for Diamond International Corp., Cloquet, MN. These logs are included in "miscellaneous" category to avoid disclosure of confidential mill data.

[2]Includes only posts processed at fence and treating plants.

[3]Includes logs and bolts used for excelsior, shavings, particleboard, lath, charcoal, and specialty products.

Table 2.—*Industrial roundwood products output by landowner class and Unit, Minnesota and Wisconsin, 1975*
(In thousand cubic feet)

MINNESOTA

Unit	Federal				Other public		Private				All owners	
	National Forest		Other				Forest industry[1]		Other			
	Soft-wood	Hard-wood	Soft-wood	Hard-wood	Soft-wood	Hard-wood	Soft-wood	Hard-wood	Soft-wood	Hard-wood	Soft-wood	Hard-wood
Northern Aspen-Birch	6,172	4,268	397	491	12,819	13,282	5,197	5,495	11,514	11,275	36,099	34,811
Northern Pine	1,740	2,986	2,101	1,069	11,339	11,755	2,430	2,209	4,907	14,288	22,517	32,307
Central Hdwd.	0	0	6	274	53	694	0	0	441	7,528	500	8,496
Prairie	0	0	0	0	([2])	3	0	0	35	945	35	948
All units	7,912	7,254	2,504	1,834	24,211	25,734	7,627	7,704	16,897	34,036	59,151	76,562
WISCONSIN												
Northeastern	2,726	6,123	105	461	1,433	9,754	5,586	8,114	7,811	24,189	17,661	48,641
Northwestern	2,303	5,567	60	388	4,153	12,266	1,813	4,613	6,185	19,339	14,514	42,173
Central	0	0	248	90	1,668	1,338	2,837	349	6,006	17,513	10,759	19,290
Southwestern	0	0	0	0	37	5	0	100	468	12,904	505	13,009
Southeastern	0	0	0	0	52	32	12	129	596	3,450	660	3,611
All units	5,029	11,690	413	939	7,343	23,395	10,248	13,305	21,066	77,395	44,099	126,724

[1]Primary wood-using firms owning forest land, except sawmills cutting less than 100,000 board feet annually.
[2]Less than 500 cubic feet.

Table 3.—*Michigan industrial roundwood production by Unit and species, 1975*
(In thousand cubic feet)

Species	All units	Eastern Upper Peninsula	Western Upper Peninsula	Northern Lower Peninsula	Southern Lower Peninsula
SOFTWOODS:					
Cedar	3,573	2,396	512	665	0
Balsam fir	6,320	2,973	2,749	598	0
Hemlock	5,799	1,511	4,182	99	7
Jack pine	16,982	3,937	1,591	11,251	203
Red pine	3,614	921	483	1,730	480
White pine	2,990	1,184	1,303	445	58
Spruce	3,884	1,526	2,218	140	0
Tamarack	337	146	191	0	0
Total	43,499	14,594	13,229	14,928	748
HARDWOODS					
Ash	1,934	133	345	766	690
Aspen	47,503	6,322	15,881	24,814	486
Balsam poplar	832	212	133	456	31
Basswood	2,490	349	648	1,039	454
Beech	3,260	2,046	108	657	449
Paper birch	3,706	737	985	1,967	17
Yellow birch	2,359	610	1,660	82	7
Cottonwood	1,004	0	0	401	603
Elm	3,527	1,231	1,644	475	177
Hickory	315	8	0	104	203
Hard maple	17,345	4,642	9,705	1,897	1,101
Soft maple	7,690	1,153	1,403	4,054	1,080
Red oak	10,972	34	535	7,988	2,415
White oak	1,817	16	0*	797	1,004
Walnut	158	0	0	0	158
Other hardwoods	369	34	80	181	74
Total	105,281	17,527	33,127	45,678	8,949
All species	148,780	32,121	46,356	60,606	9,697

Table 4.—*Minnesota industrial roundwood production by Unit and species, 1975*
(In thousand cubic feet)

Species	All units	Northern Aspen-Birch	Northern Pine	Central Hardwood	Prairie
SOFTWOODS:					
Cedar	1,078	946	131	1	0
Balsam fir	9,983	6,255	3,724	4	0
Hemlock	0	0	0	0	0
Jack pine	21,047	11,136	9,497	414	0
Red pine	3,492	1,324	2,120	48	0
White pine	2,527	1,616	890	21	0
Spruce	16,561	12,403	4,155	3	0
Tamarack	4,463	2,419	2,000	9	35
Total	59,151	36,099	22,517	500	35
HARDWOODS:					
Ash	690	83	429	142	36
Aspen	62,866	31,495	27,860	3,509	2
Balsam poplar	1,070	878	106	86	0
Basswood	893	23	357	460	53
Beech	0	0	0	0	0
Paper birch	4,018	2,070	1,813	135	0
Yellow birch	3	2	1	0	0
Cottonwood	612	0	0	174	438
Elm	1,835	15	555	821	308
Hickory	13	0	0	13	0
Hard maple	226	4	49	160	13
Soft maple	158	4	47	84	23
Red oak	3,341	101	933	2,275	32
White oak	758	0	157	569	32
Walnut	61	0	0	50	11
Other hardwoods	18	0	0	18	0
Total	76,562	34,811	32,307	8,496	948
All species	135,713	70,910	54,824	8,996	983

Table 5.—*Wisconsin industrial roundwood production by Unit and species, 1975*
(In thousand cubic feet)

Species	All units	Northeastern	Northwestern	Central	Southwestern	Southeastern
SOFTWOODS:						
Cedar	445	411	12	1	0	21
Balsam fir	8,137	5,108	2,954	75	0	0
Hemlock	4,602	3,255	1,075	255	0	17
Jack pine	12,656	2,041	4,400	5,964	67	184
Red pine	8,777	2,454	2,469	3,274	383	197
White pine	6,807	2,772	2,610	1,129	55	241
Spruce	2,392	1,485	877	30	0	0
Tamarack	283	135	117	31	0	0
Total	44,099	17,661	14,514	10,759	505	660
HARDWOODS:						
Ash	3,304	963	1,241	748	194	158
Aspen	60,695	27,233	27,815	5,198	359	90
Balsam poplar	37	18	0	0	0	19
Basswood	4,122	1,192	1,095	764	903	168
Beech	260	185	0	4	0	71
Paper birch	6,689	2,925	3,247	403	83	31
Yellow birch	1,721	842	596	269	11	3
Cottonwood	229	5	2	11	145	66
Elm	12,397	5,711	1,980	3,240	737	729
Hickory	335	64	4	21	238	8
Hard maple	11,190	5,794	2,633	1,573	1,003	187
Soft maple	5,179	1,553	1,363	1,391	468	404
Red oak	16,239	1,795	1,964	4,631	6,821	1,028
White oak	3,774	151	175	961	1,906	581
Walnut	178	1	15	0	117	45
Other hardwoods	375	209	43	76	24	23
Total	126,724	48,641	42,173	19,290	13,009	3,611
All species	170,823	66,302	56,687	30,049	13,514	4,271

Table 6.—*Active primary wood-using mills in the Lake States, by State, 1975*
(In numbers)

Type of mill	Michigan	Minnesota	Wisconsin	Total
Pulp mill	8	9	24	41
Saw Mill:				
Large[1]	12	8	12	32
Medium[2]	76	29	86	191
Small[3]	174	162	216	552
Total	262	199	314	775
Veneer mill:				
Standard grade	3	2	9	14
Container	5	2	10	17
Total	8	4	19	31
Other[4]	15	17	10	42
Total	293	229	367	889

[1]Annual lumber production of 5 million board feet or more.
[2]Annual lumber production of 1 million to 4.999 million board feet.
[3]Annual lumber production of less than 1 million board feet.
[4]Includes fence, treating, particleboard, cabin log, charcoal, lath, cooperage, shavings, excelsior, and specialty product plants.

Table 7.—*Lake States pulpwood production by State, species group, and destination, 1975*
(In thousand standard cords, unpeeled)

MICHIGAN

Species group	Destination of wood				
	Michigan	Minnesota	Wisconsin	Other States and Canada	Total
ROUNDWOOD:[1]					
Balsam fir	18	0	53	3	74
Pine	165	0	70	0	235
Spruce	6	0	37	2	45
Other softwoods	23	0	32	0	55
Aspen	286	0	150	0	436
Birch	32	0	4	0	36
Maple	70	0	32	0	102
Oak	59	0	(2)	0	59
Other hardwoods	40	0	16	0	56
Total	699	0	394	5	1,098
RESIDUE:					
Softwood	8	0	12	2	22
Hardwood	107	0	43	10	160
All material	814	0	449	17	1,280

MINNESOTA[3]

ROUNDWOOD:[1]					
Balsam fir	0	116	4	1	121
Pine	0	154	42	3	199
Spruce	0	163	38	1	202
Other softwoods	0	31	25	0	56
Aspen	0	548	66	2	616
Birch	0	33	2	0	35
Other hardwoods	0	21	1	0	22
Total	0	1,066	178	7	1,251
RESIDUE:					
Softwood	0	43	(2)	1	44
Hardwood	0	64	(2)	0	64
All material	0	1,173	178	8	1,359

WISCONSIN

ROUNDWOOD:[1]					
Balsam fir	1	0	97	0	98
Pine	3	0	237	0	240
Spruce	(2)	0	25	0	25
Other softwoods	3	0	46	0	49
Aspen	3	10	575	(2)	588
Birch	1	0	82	(2)	83
Maple	1	0	98	1	100
Oak	(2)	0	48	1	49
Other hardwoods	(2)	0	94	1	95
Total	12	10	1,302	3	1,327
RESIDUE:					
Softwood	(2)	0	36	0	36
Hardwood	7	10	122	3	142
All material	19	20	1,460	6	1,505

[1]Includes chips from roundwood.
[2]Less than 500 cords.
[3]Some Minnesota wood sent to Canada is reported as remaining in Minnesota to protect confidentiality of wood use at individual mills.

Table 8.—*Lake States pulpwood production from roundwood by county and species, 1975*

(In standard cords, unpeeled)

MICHIGAN

UNIT AND COUNTY 1/	BALSAM FIR	CEDAR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD
E. UPPER PENINSULA												
ALGER	485	251	2260	9904	1618	816	157	44	16	978	188	63
CHIPPEWA	2413	161	689	4416	520	377	1223	303	15	5026	267	50
DELTA	12063	430	4427	8108	1688	759	4588	105	158	20450	348	124
LUCE	4208	239	1222	12724	1482	823	2751	130	89	2936	297	99
MACKINAC	1742	273	1143	2782	527	342	459	56	23	3140	245	81
MENOMINEE	10972	82	1814	988	204	96	5788	322	616	30913	161	59
SCHOOLCRAFT	3819	518	4479	8351	1453	1034	3328	165	49	5093	469	156
TOTAL	35702	1954	16034	47273	7492	4247	18294	1125	966	68536	1975	632
W. UPPER PENINSULA												
BARAGA	1019	128	5058	1355	261	325	854	78	133	23748	392	131
DICKINSON	4014	116	967	1409	187	261	2732	550	85	34976	225	78
GOGEBIC	1737	14	11932	736	101	39	1909	50	174	18026	0	80
HOUGHTON	1578	38	2252	736	88	70	643	6	47	3246	33	15
IRON	16230	97	3577	2518	1015	334	11633	156	856	28907	197	281
KEWEENAW	593	0	178	0	0	0	592	0	0	0	0	0
MARQUETTE	7682	478	6509	11608	1545	1617	6522	316	102	9894	809	274
ONTONAGON	684	93	3696	256	113	183	157	15	772	18981	14	6
TOTAL	33537	964	34169	18618	3310	2829	25042	1171	2169	137778	1670	865
N. LOWER PENINSULA												
ALCONA	391	0	0	378	0	0	130	0	440	18758	844	444
ALPENA	738	0	0	222	22	0	238	0	560	6405	355	559
BENZIE	0	0	0	0	0	0	0	0	104	6974	0	0
CHEBOYGAN	694	0	0	2779	0	0	326	0	500	14196	779	488
CLARE	0	0	0	2895	0	0	0	0	85	11329	25	68
CRAWFORD	0	0	0	11905	285	150	0	0	0	695	0	0
EMMET	0	0	0	474	0	0	0	0	0	0	0	0
GLADWIN	0	0	0	877	0	0	0	0	53	8037	148	0
GRAND TRAVERSE	0	0	0	757	0	0	0	0	42	3286	0	0
IOSCO	0	0	0	14559	0	0	0	0	20	1642	141	22
ISABELLA	0	0	0	0	0	0	0	0	59	5335	27	48
KALKASKA	0	0	0	1898	0	0	0	0	14	2487	0	0
LAKE	0	0	0	13186	0	0	0	0	784	9826	204	542
LEELANAU	0	0	0	0	444	0	0	0	104	2704	0	0
MANISTEE	0	0	0	3561	0	0	0	0	484	10545	75	81
MASON	0	0	0	0	939	0	0	0	328	5241	36	157
MECOSTA	0	0	0	0	2467	0	0	0	198	9208	79	236
MIDLAND	0	0	0	0	0	0	0	0	0	492	0	0
MISSAUKEE	0	0	0	0	738	0	0	0	208	8008	0	0
MONTMORENCY	977	0	0	14207	0	0	369	0	414	22626	734	430
NEWAYGO	0	0	0	0	4308	0	0	0	1040	8136	369	931
OCEANA	0	0	0	0	2196	0	0	0	9	3458	53	2
OGEMAW	0	0	0	6873	0	0	0	0	20	2355	44	22
OSCEOLA	0	0	0	0	2595	0	0	0	634	12289	268	791
OSCODA	86	0	0	15889	0	0	22	0	323	25440	555	222
OTSEGO	0	0	0	2539	0	0	0	0	0	603	0	0
PRESQUE ISLE	1454	0	0	7568	0	0	694	0	320	11359	555	333
ROSCOMMON	0	0	0	6684	0	0	0	0	32	7970	0	0
WEXFORD	0	0	0	21406	0	0	0	0	28	8452	0	0
TOTAL	4340	0	0	128657	13994	150	1779	0	6803	227850	5291	5376
S. LOWER PENINSULA												
ALLEGAN	0	0	0	315	0	0	0	0	6	372	0	2
CASS	0	0	0	0	328	0	0	0	0	94	0	0
GRATIOT	0	0	0	322	0	0	0	0	5	104	0	2
IONIA	0	0	0	0	318	0	0	0	0	0	0	0
KALAMAZOO	0	0	0	0	0	0	0	0	22	40	1	6
KENT	0	0	0	1930	0	0	0	0	1	34	0	0
MONTCALM	0	0	0	0	744	0	0	0	138	707	10	49
MUSKEGON	0	0	0	0	3830	0	0	0	2	14	0	0
OTTAWA	0	0	0	0	581	0	0	0	0	0	0	0
TOTAL	0	0	0	2567	5801	0	0	0	174	1365	11	59
STATE TOTAL	73579	2918	50203	197115	30597	7226	45115	2296	10112	435529	8947	6932

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1975.

(TABLE 8 CONTINUED ON NEXT PAGE)

(TABLE 8 CONTINUED)

MICHIGAN

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD-WOODS	ALL SPECIES
E. UPPER PENINSULA												
ALGER	809	244	156	0	94	0	657	528	6	0	9	19283
CHIPPEWA	521	280	126	0	76	0	424	366	4	0	6	17263
DELTA	1047	835	327	0	381	0	1087	1031	51	0	24	58031
LUCE	1178	772	331	0	268	0	1426	938	37	1	13	31964
MACKINAC	756	528	204	0	122	0	686	585	8	0	10	13712
MENOMINEE	1017	481	159	0	5012	115	5319	1776	17	0	9	65920
SCHOOLCRAFT	1715	823	395	0	239	0	1385	1389	13	0	20	34893
TOTAL	7043	3963	1698	0	6192	115	10984	6613	136	1	91	241066
W. UPPER PENINSULA												
BARAGA	0	596	438	0	485	0	3397	1080	70	0	35	39583
DICKINSON	0	465	202	0	219	0	892	431	17	0	7	47833
GOGEBIC	0	547	316	0	1307	0	2928	620	0	0	317	40833
HOUGHTON	0	250	189	0	75	0	1040	249	2	0	3	10560
IRON	0	744	1070	0	3907	0	11228	2306	13	0	452	85521
KEWEENAW	0	0	0	0	0	0	0	0	0	0	0	1363
MARQUETTE	2	972	695	0	483	0	4798	1663	72	0	17	56058
ONTONAGON	0	794	1016	0	2771	0	8775	2165	375	0	1	40867
TOTAL	2	4368	3926	0	9247	0	33058	8514	549	0	832	322618
N. LOWER PENINSULA												
ALCONA	20	1182	0	0	22	0	20	2554	9425	457	0	35065
ALPENA	52	671	6	4	45	0	124	1631	1299	49	6	12986
BENZIE	312	759	10	0	0	0	208	2600	1314	104	208	12593
CHEBOYGAN	20	2606	0	0	0	0	20	1976	73	0	0	20457
CLARE	89	739	10	8	0	1	135	1464	1908	148	15	18918
CRAWFORD	0	0	0	0	0	0	0	208	211	0	0	13454
EMMET	0	0	0	0	0	0	0	0	0	0	0	474
GLADWIN	156	834	0	104	0	0	54	1059	1306	72	52	12752
GRAND TRAVERSE	42	529	0	0	0	0	208	520	1144	37	21	6586
IOSCO	0	402	0	0	0	0	0	408	45	0	0	17239
ISABELLA	31	163	9	0	0	1	97	102	21	32	12	5945
KALKASKA	52	221	0	0	0	0	0	803	603	21	0	6132
LAKE	490	1373	62	86	0	12	971	3956	4869	2405	241	39001
LEELANAU	104	219	15	0	0	0	104	156	104	0	42	3996
MANISTEE	477	903	63	9	0	2	777	3230	5200	688	384	26479
MASON	211	335	24	21	0	6	436	2809	1213	410	249	12415
MECOSTA	174	593	37	28	0	7	521	359	398	294	57	14656
MIDLAND	0	0	0	0	0	0	0	0	0	0	0	492
MISSAUKEE	104	732	0	0	0	0	52	836	1053	2	104	11837
MONTMORENCY	86	939	25	14	22	3	327	1385	3639	146	32	46377
NEWAYGO	650	1151	140	123	0	27	1659	1922	3313	1615	273	25657
OCEANA	20	171	0	0	0	0	18	120	984	151	1	7183
OGEMAW	0	85	0	0	0	0	20	348	684	0	0	10451
OSCEOLA	557	1248	113	89	0	23	1540	1034	1805	351	180	23517
OSCODA	67	2113	0	0	0	0	40	2559	6027	237	0	53580
OTSEGO	0	29	0	0	0	0	0	208	176	0	0	3555
PRESQUE ISLE	20	2943	0	0	22	0	20	1903	110	0	0	27301
ROSCOMMON	73	310	0	0	0	0	21	258	2620	41	0	18009
WEXFORD	52	471	0	0	0	0	35	337	630	70	26	31507
TOTAL	3861	21721	514	494	111	82	7410	34745	50204	7330	1903	522615
S. LOWER PENINSULA												
ALLEGAN	2	1	0	3	0	4	6	12	274	12	4	1013
CASS	0	0	0	0	0	0	0	1	6		0	431
GRATIOT	2	1	0	2	0	2	3	9	8			470
IONIA	0	0	0	0	0	0	0	0	0	0	0	316
KALAMAZOO	6	2	1	5	0	12	12	34	0	3	14	186
KENT	0	1	0	0	0	0	2	11	50	19	8	2048
MONTCALM	51	33	7	41	0	88	129	298	230	295	94	2914
MUSKEGON	0	4	0	0	0	0	4	19	117	46	0	4036
OTTAWA	0	0	0	0	0	0	0	0	0	0	0	581
TOTAL	61	42	8	51	0	106	156	384	685	412	115	11997
STATE TOTAL	10967	30094	6146	545	15550	303	51608	50256	51574	7743	2941	1098296

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1975.

(TABLE 8 CONTINUED ON NEXT PAGE)

(TABLE 8 CONTINUED)

MINNESOTA

UNIT AND COUNTY 1/	BALSAM FIR	CEDAR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD
NORTHERN ASPEN-BIRCH												
CARLTON	524	0	0	1938	500	0	262	259	0	17338	0	0
COOK	1479	0	0	3780	74	0	8447	0	0	15915	0	0
KOOCHICHING	39643	0	0	12558	1823	2540	75689	23458	0	126238	6107	0
LAKE	12009	0	0	21052	950	0	24670	68	0	13420	0	0
ST.LOUIS	22796	0	0	64191	3429	3688	43795	6842	0	184212	3701	0
TOTAL	76451	0	0	103519	6776	6228	152863	30627	0	357123	9808	0
NORTHERN PINE												
AITKIN	662	0	0	1333	0	0	1468	4113	0	34528	0	0
BECKER	0	0	0	925	0	0	0	69	0	760	0	0
BELTRAMI	12819	0	0	10865	843	404	8709	5027	0	48843	12	0
CASS	2509	0	0	14926	1291	12	1013	972	45	25038	0	0
CLEARWATER	1609	0	0	6639	139	0	4326	6747	10	6752	0	0
CROW WING	0	0	0	4554	500	0	0	300	0	9248	0	0
HUBBARD	286	0	0	8713	500	0	492	1010	0	31572	0	0
ITASCA	26057	0	0	7399	741	742	16055	5312	0	56522	220	0
LAKE OF THE WOODS	611	0	0	2397	0	0	11361	299	0	13218	662	0
MAHNOMEN	0	0	0	1184	0	0	29	152	0	760	0	0
ROSEAU	292	0	0	9970	0	0	5688	1069	0	7590	23	0
WADENA	0	0	0	4600	0	0	0	0	0	1415	0	0
TOTAL	44845	0	0	73505	4014	1158	49141	25070	55	236246	917	0
CENTRAL HARDWOOD												
BENTON	0	0	0	0	0	0	0	0	0	129	0	0
KANABEC	0	0	0	0	0	0	0	0	0	916	0	0
MILLE LACS	0	0	0	0	0	0	0	85	0	7012	0	0
MORRISON	0	0	0	1139	0	0	0	0	0	6341	0	0
OTTERTAIL	0	0	0	570	0	0	0	0	0	0	0	0
PINE	0	0	0	1240	0	0	0	27	0	8228	0	0
TODD	0	0	0	570	0	0	0	0	0	0	0	0
TOTAL	0	0	0	3519	0	0	0	112	0	22626	0	0
PRAIRIE												
POLK	0	0	0	0	0	0	0	457	0	0	0	0
TOTAL	0	0	0	0	0	0	0	457	0	0	0	0
STATE TOTAL	121296	0	0	180543	10790	7386	202004	56266	55	615995	10725	0

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1975.

(TABLE 8 CONTINUED ON NEXT PAGE)

(TABLE 8 CONTINUED)

MINNESOTA

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD-WOODS	ALL SPECIES
NORTHERN ASPEN-BIRCH												
CARLTON	0	3131	0	0	0	0	19	8	376	0	0	24167
COOK	0	0	0	0	0	0	0	0	0	0	0	29695
KOOCHICHING	0	2947	0	0	692	0	14	17	693	0	0	292419
LAKE	0	2036	0	0	0	0	0	0	0	0	0	74205
ST.LOUIS	0	7683	0	0	0	0	8	35	0	0	0	340379
TOTAL	0	15796	0	0	692	0	41	60	1069	0	0	761055
NORTHERN PINE												
AITKIN	0	2515	0	0	0	0	0	0	5541	0	0	50160
BECKER	0	0	0	0	0	0	0	0	0	0	0	1754
BELTRAMI	0	5989	0	0	0	0	57	3	0	0	0	93571
CASS	0	2915	3	0	24	0	34	8	0	0	0	48792
CLEARWATER	0	1002	0	0	17	0	44	3	0	0	0	27288
CROW WING	0	469	0	0	0	0	0	0	275	0	0	15346
HUBBARD	0	1371	0	0	0	0	0	0	0	0	0	43944
ITASCA	0	2614	0	0	0	0	24	5	0	0	0	115891
LAKE OF THE WOODS	0	0	0	0	0	0	0	0	0	0	0	28548
MAHNOMEN	0	466	0	0	0	0	0	0	0	0	0	2585
ROSEAU	0	500	0	0	0	0	0	0	0	0	0	25132
WADENA	0	390	0	0	0	0	0	0	0	0	0	6405
TOTAL	0	18225	3	0	41	0	159	19	5818	0	0	459216
CENTRAL HARDWOOD												
BENTON	0	1	0	0	0	0	0	0	0	0	0	129
KANABEC	0	171	0	0	0	0	0	0	690	0	0	1779
MILLE LACS	0	359	0	0	0	0	0	0	1438	0	0	8894
MORRISON	0	173	0	0	0	0	0	0	690	0	0	8343
OTTERTAIL	0	0	0	0	0	0	0	0	0	0	0	570
PINE	0	746	0	0	0	0	0	0	0	0	0	10241
TODD	0	0	0	0	0	0	0	0	0	0	0	117
TOTAL	0	1451	0	0	0	0	0	0	2818	0	0	30525
PRAIRIE												
POLK	0	0	0	0	0	0	0	0	0	0	0	457
TOTAL	0	0	0	0	0	0	0	0	0	0	0	457
STATE TOTAL	0	35474	3	0	733	0	200	79	9703	0	2	1251254

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1976.

(TABLE CONTINUED ON NEXT PAGE)

(TABLE 8 CONTINUED)

WISCONSIN

UNIT AND COUNTY 1/	BALSAM FIR	CEDAR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD
NORTHEASTERN												
FLORENCE	3033	5	974	1035	675	100	1715	29	101	28958	0	24
FOREST	12926	93	7483	1838	3076	362	2597	167	910	37790	10	274
LANGLADE	3198	0	1063	500	1046	89	660	298	1078	24569	0	404
LINCOLN	3659	0	1336	705	1074	154	802	498	3270	32492	0	1717
MARINETTE	10328	165	2990	2748	3662	727	2188	157	771	58860	40	21
OCONTO	1541	22	593	1509	1496	142	706	4	10	18383	0	0
ONEIDA	18177	1	1739	5193	6436	668	6148	467	1383	39700	0	589
SHAWANO 2/	130	0	9190	191	1010	75	20	0	608	7056	0	5
VILAS	10997	0	4991	7991	2922	838	3392	84	174	38414	0	90
TOTAL	63989	286	30359	21710	21397	3155	18228	1704	8305	286222	50	3124
NORTHWESTERN												
ASHLAND	9875	0	2053	5657	2009	412	2292	158	1354	20801	0	192
BARRON	0	0	0	154	30	12	46	0	41	0	0	4
BAYFIELD	3850	0	1252	5456	2976	346	615	0	728	45829	0	57
BURNETT	0	0	0	12053	2889	744	12	95	0	4320	0	0
DOUGLAS	340	0	145	11450	1606	231	52	0	74	18553	0	2
IRON	3177	0	2690	138	218	32	569	0	838	52632	0	652
POLK	0	0	0	1647	320	103	0	0	0	0	0	0
PRICE	7412	0	1958	1160	2001	255	1195	557	3689	44654	0	2418
RUSK	131	0	107	72	61	15	0	46	956	7942	0	679
SAWYER	5031	0	693	1313	1490	206	1353	127	2142	19640	0	514
TAYLOR	2847	0	3671	338	623	216	197	466	3178	22427	0	953
WASHBURN	705	0	0	5785	1740	287	227	0	171	39383	0	8
TOTAL	33368	0	12569	45223	15963	2859	6558	1449	13171	276181	0	5479
CENTRAL												
ADAMS	0	0	0	19728	8792	1471	0	0	227	64	0	14
CHIPPEWA	144	0	98	246	400	20	22	150	773	6542	0	451
CLARK	118	0	14	1837	1945	206	111	0	1033	1981	0	62
EAU CLAIRE	0	0	0	3942	2262	374	0	0	0	127	0	0
JACKSON	0	0	0	9167	4385	750	0	0	110	276	0	5
JUNEAU	0	0	0	10341	3671	755	54	24	329	408	0	1
MARATHON	606	0	2092	767	653	98	64	6	1623	8023	0	57
MARQUETTE	0	0	0	912	1619	151	0	105	227	15	0	9
MONROE	0	0	0	3379	1662	283	0	0	18	59	0	1
PORTAGE	41	0	212	2750	3180	499	47	88	605	2884	0	41
WAUPACA	4	0	4	365	1239	97	18	15	139	2351	0	7
WAUSHARA	0	0	5	2130	3744	341	0	0	59	50	0	3
WOOD	0	0	98	19834	6826	1378	2	8	1427	2176	0	81
TOTAL	913	0	2523	75398	40377	6423	318	396	6570	24956	0	732
SOUTHWESTERN												
BUFFALO	0	0	0	0	0	0	0	0	0	10	0	0
CRAWFORD	0	0	0	0	0	0	0	0	162	15	0	8
DUNN	0	0	0	285	547	52	0	0	0	0	0	0
GRANT	0	0	0	0	0	0	0	0	15	1	0	1
IOWA	0	0	0	0	0	0	0	0	0	26	0	0
LACROSSE	0	0	0	130	225	19	0	0	0	0	0	0
PEPIN	0	0	0	336	438	41	0	0	0	0	0	0
RICHLAND	0	0	0	30	42	4	0	0	0	0	0	0
SAUK	0	0	0	73	144	11	0	0	0	0	0	0
TREMPEALEAU	0	0	0	20	27	2	0	0	0	0	0	0
TOTAL	0	0	0	874	1423	129	0	0	177	52	0	9
SOUTHEASTERN												
BROWN	0	0	19	64	162	10	0	0	0	113	0	0
COLUMBIA	0	0	0	249	1548	82	0	0	66	0	0	2
DANE	0	0	0	197	57	14	0	0	0	0	0	0
GREEN	0	0	0	594	199	42	0	0	0	0	0	0
GREEN LAKE	0	0	0	309	215	27	0	0	38	0	0	0
KEWAUNEE	0	0	0	0	0	0	0	0	0	25	0	0
MANITOWOC	0	0	0	0	0	0	0	0	0	14	0	0
MILWAUKEE	0	0	0	0	0	0	0	0	0	0	0	0
OUTAGAMIE	0	0	0	9	76	4	0	0	0	3	0	0
ROCK	0	0	0	182	115	38	0	0	0	0	0	0
WAUKESHA	0	0	0	757	44	75	0	0	0	0	0	0
TOTAL	0	0	19	2361	2416	292	0	0	104	155	0	2
STATE TOTAL	98270	286	45470	145566	81576	12858	25104	3549	28327	587566	50	9346

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1975.
2/ INCLUDES MENOMINEE COUNTY.

(TABLE 8 CONTINUED ON NEXT PAGE)

(TABLE 8 CONTINUED)

WISCONSIN

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD-WOODS	ALL SPECIES
NORTHEASTERN												
FLORENCE	0	300	313	0	815	0	1706	199	103	0	58	40143
FOREST	32	1234	984	0	3160	0	7082	1042	237	0	403	81700
LANGLADE	175	1158	618	0	3584	0	5653	1748	380	0	412	46633
LINCOLN	0	4220	838	0	4377	24	5694	3888	1788	0	221	66757
MARINETTE	58	4880	342	0	636	0	998	1447	512	48	24	91602
OCONTO	7	16	3	0	64	0	70	30	24	0	0	24620
ONEIDA	0	7658	696	0	875	0	2561	3605	4005	0	167	100068
SHAWANO 2/	1370	196	47	0	6425	442	668	398	108	3	453	28395
VILAS	0	8117	1232	0	671	0	5140	1391	1741	66	102	88353
TOTAL	1642	27779	5073	0	20607	466	29572	13748	8898	117	1840	568271
NORTHWESTERN												
ASHLAND	0	3275	575	0	1023	0	2541	1657	592	64	54	54584
BARRON	0	28	9	0	44	0	72	43	56	11	2	552
BAYFIELD	0	7147	270	0	615	0	1427	880	1032	77	32	72589
BURNETT	0	49	0	0	0	0	0	0	0	0	0	20162
DOUGLAS	0	3178	21	0	63	0	98	75	23	6	4	35921
IRON	0	3032	309	0	752	0	1487	849	614	14	41	68044
POLK	0	0	0	0	0	0	0	0	0	0	0	2070
PRICE	0	7910	1507	0	2809	0	5664	3630	2192	61	149	89221
RUSK	0	1431	425	0	1554	0	1667	1217	782	16	47	17148
SAWYER	0	6168	715	0	1730	0	3612	2354	1882	182	103	49255
TAYLOR	0	4835	1481	0	5327	45	6345	3829	1536	48	139	58501
WASHBURN	0	1224	38	0	152	0	217	166	212	39	9	50363
TOTAL	0	38277	5350	0	14069	45	23130	14700	8921	518	580	518410
CENTRAL												
ADAMS	0	160	35	0	445	0	113	287	2470	620	28	34454
CHIPPEWA	7	1174	646	0	1863	0	1398	1667	362	40	7	16010
CLARK	1	693	285	0	2130	0	1095	1682	3577	886	111	17767
EAU CLAIRE	0	0	0	0	0	0	0	0	0	0	0	6705
JACKSON	0	149	29	0	210	0	110	211	838	193	20	16453
JUNEAU	0	185	48	0	596	0	105	280	2051	565	28	19441
MARATHON	0	943	706	0	5714	40	3019	3694	4589	543	104	33341
MARQUETTE	0	175	29	0	403	0	83	275	1163	346	28	5540
MONROE	0	31	4	0	35	0	20	39	627	123	0	6281
PORTAGE	0	252	121	0	1309	0	418	743	2299	695	48	16232
WAUPACA	0	112	22	0	234	0	65	150	370	115	10	5316
WAUSHARA	0	28	9	0	111	0	27	63	377	108	6	7061
WOOD	0	678	212	0	2483	0	677	1589	5252	1515	98	44334
TOTAL	8	4580	2146	0	15533	40	7130	10680	23975	5749	488	228935
SOUTHWESTERN												
BUFFALO	0	0	0	0	0	0	0	0	0	0	0	10
CRAWFORD	0	7	0	295	111	243	472	295	343	130	7	2088
DUNN	0	0	0	0	0	0	0	0	0	0	0	884
GRANT	0	1	0	28	10	23	44	28	32	12	1	196
IOWA	0	0	0	0	0	0	0	0	0	0	0	26
LACROSSE	0	0	0	0	0	0	0	0	0	0	0	374
PEPIN	0	0	0	0	0	0	0	0	0	0	0	815
RICHLAND	0	0	0	0	0	0	0	0	0	0	0	76
SAUK	0	0	0	0	0	0	0	0	0	0	0	228
TREMPEALEAU	0	0	0	0	0	0	0	0	0	0	0	49
TOTAL	0	8	0	323	121	266	516	323	375	142	8	4746
SOUTHEASTERN												
BROWN	0	0	0	0	0	0	0	0	0	0	0	368
COLUMBIA	0	8	1	0	43	0	37	29	171	114	24	2374
DANE	0	0	0	0	136	0	0	0	0	0	0	404
GREEN	0	0	0	0	0	0	0	0	0	0	0	835
GREEN LAKE	10	9	2	0	71	0	36	23	0	0	22	762
KEWAUNEE	0	0	0	0	0	0	0	0	0	0	0	25
MANITOWOC	0	0	0	0	0	0	0	0	0	0	0	14
MILWAUKEE	0	0	0	0	376	0	0	0	0	0	0	376
OUTAGAMIE	0	0	0	0	0	0	0	0	0	0	0	92
ROCK	0	0	0	0	0	0	0	0	0	0	0	335
WAUKESHA	0	0	0	0	0	0	0	0	0	0	0	876
TOTAL	10	17	3	0	626	0	73	52	171	114	46	6461
STATE TOTAL	1660	70661	12572	323	50956	817	60421	39503	42340	6640	2962	1326823

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1975.
2/ INCLUDES MENOMINEE COUNTY.

Table 9.—*Lake States saw log production by State, species, and selected year*
(In thousand board feet)[1]

Species	Michigan			Minnesota			Wisconsin			Lake States
	1965	1975	Change	1960	1975	Change	1967	1975	Change	1975
SOFTWOODS:										
Cedar	1,032	2,502	1,470	2,050	4,589	2,539	769	1,711	942	8,802
Balsam fir	2,193	776	–1,417	4,170	2,100	–2,070	136	1,948	1,812	4,824
Hemlock	18,022	12,980	–5,042	0	0	0	3,279	6,079	2,800	19,059
Jack pine	1,599	7,926	6,327	23,468	29,058	5,590	476	5,050	4,574	42,034
Red pine	4,425	6,835	2,410	16,090	10,680	–5,410	3,604	11,728	8,124	29,243
White pine	10,410	16,989	6,579	25,678	11,272	–14,406	20,135	34,608	14,473	62,869
Spruce	1,172	1,897	725	3,383	3,145	–238	248	2,106	1,858	7,148
Tamarack	12	0	–12	1,287	79	–1,208	33	18	–15	97
Total	38,865	49,905	11,040	76,126	60,923	–15,203	28,680	63,248	34,568	174,076
HARDWOODS:										
Ash	9,025	7,503	–1,522	4,223	3,954	–269	6,571	5,866	–705	17,323
Aspen	35,748	63,180	27,432	37,587	49,501	11,914	30,726	50,061	19,335	162,742
Balsam poplar	4,976	851	–4,125	621	1,269	648	28	208	180	2,328
Basswood	15,879	12,494	–3,385	9,165	4,369	–4,796	22,061	19,181	–2,880	36,044
Beech	18,073	15,915	–2,158	0	0	0	1,222	794	–428	16,709
Paper birch	5,207	8,104	2,897	3,722	2,728	–994	2,899	6,341	3,442	17,173
Yellow birch	19,591	10,243	–9,348	874	0	–874	5,302	3,758	–1,544	14,001
Cottonwood	5,417	6,144	727	4,993	3,196	–1,797	1,595	1,117	–478	10,457
Elm	60,845	15,181	–45,664	8,876	9,508	632	30,866	45,883	15,017	70,572
Hard maple	80,611	87,156	6,545	585	934	349	42,010	35,982	–6,028	124,072
Soft maple	27,524	24,588	–2,936	1,582	781	–801	12,195	11,498	–697	36,867
Red oak	41,780	46,045	4,265	15,033	14,355	–678	73,115	69,779	–3,336	130,179
White oak	12,674	8,196	–4,478	4,147	4,187	40	11,358	17,547	6,189	29,930
Walnut	357	809	452	234	236	2	794	882	88	1,927
Other hardwoods	10,893	2,922	–7,971	342	182	–160	3,088	2,541	–547	5,645
Total	348,600	309,331	–39,269	91,984	95,200	3,216	243,830	271,438	27,608	675,969
All species	387,465	359,236	–28,229	168,110	156,123	–11,987	272,510	334,686	62,176	850,045

[1]International ¼-inch rule.

Table 10.—*Lake States saw log production by State, species and State of destination, 1975*
(In thousand board feet)[1]

MICHIGAN

Species	Destination of wood					Total
	Michigan	Wisconsin	Indiana	Kentucky	Other States	
SOFTWOODS:						
Cedar	2,496	6	0	0	0	2,502
Balsam fir	561	215	0	0	0	776
Hemlock	12,955	25	0	0	0	12,980
Jack pine	7,478	448	0	0	0	7,926
Red pine	6,222	613	0	0	0	6,835
White pine	16,193	796	0	0	0	16,989
Spruce	1,749	148	0	0	0	1,897
Tamarack	0	0	0	0	0	0
Total	47,654	2,251	0	0	0	49,905
HARDWOODS:						
Ash	7,226	37	240	0	0	7,503
Aspen	48,510	14,665	5	0	0	63,180
Balsam poplar	851	0	0	0	0	851
Basswood	11,033	1,327	134	0	0	12,494
Beech	15,789	2	124	0	0	15,915
Paper birch	4,995	3,109	0	0	0	8,104
Yellow birch	9,899	344	0	0	0	10,243
Cottonwood	6,111	0	33	0	0	6,144
Elm	14,486	680	15	0	0	15,181
Hickory	1,970	0	15	0	0	1,985
Hard maple	84,668	1,938	550	0	0	87,156
Soft maple	23,989	152	447	0	0	24,588
Red oak	44,951	483	610	1	0	46,045
White oak	7,814	0	381	1	0	8,196
Walnut	686	0	78	45	0	809
Other species	795	0	128	14	0	937
Total	283,773	22,737	2,760	61	0	309,331
All species	331,427	24,988	2,760	61	0	359,236

(Table 10 continued on next page)

(Table 10 continued)

MINNESOTA

Species	Destination of wood					
	Minnesota	Wisconsin	Missouri	Kentucky	Other States	Total
SOFTWOODS:						
Cedar	4,589	0	0	0	0	4,589
Balsam fir	1,927	173	0	0	0	2,100
Hemlock	0	0	0	0	0	0
Jack pine	28,475	583	0	0	0	29,058
Red pine	10,212	468	0	0	0	10,680
White pine	10,992	280	0	0	0	11,272
Spruce	3,046	99	0	0	0	3,145
Tamarack	79	0	0	0	0	79
Total	59,320	1,603	0	0	0	60,923
HARDWOODS:						
Ash	3,923	31	0	0	0	3,954
Aspen	49,399	102	0	0	0	49,501
Balsam poplar	1,269	0	0	0	0	1,269
Basswood	4,285	84	0	0	0	4,369
Beech	0	0	0	0	0	0
Paper birch	2,717	11	0	0	0	2,728
Yellow birch	0	0	0	0	0	0
Cottonwood	3,186	10	0	0	0	3,196
Elm	9,426	82	0	0	0	9,508
Hickory	67	11	0	0	0	78
Hard maple	896	38	0	0	0	934
Soft maple	668	113	0	0	0	781
Red oak	13,064	1,291	0	0	0	14,355
White oak	3,953	234	0	0	0	4,187
Walnut	131	0	70	28	7	236
Other hardwoods	104	0	0	0	0	104
Total	93,088	2,007	70	28	7	95,200
All species	152,408	3,610	70	28	7	156,123

(Table 10 continued on next page)

(Table 10 continued)

WISCONSIN

Species	Destination of wood					
	Wisconsin	Michigan	Illinois	Iowa	Other States	Total
SOFTWOODS:						
Cedar	1,667	44	0	0	0	1,711
Balsam fir	1,871	77	0	0	0	1,948
Hemlock	6,078	1	0	0	0	6,079
Jack pine	4,879	171	0	0	0	5,050
Red pine	11,421	307	0	0	0	11,728
White pine	33,993	615	0	0	0	34,608
Spruce	2,062	44	0	0	0	2,106
Tamarack	18	0	0	0	0	18
Total	61,989	1,259	0	0	0	63,248
HARDWOODS:						
Ash	5,811	37	18	0	0	5,866
Aspen	49,838	86	127	10	0	50,061
Balsam poplar	208	0	0	0	0	208
Basswood	18,944	222	15	0	0	19,181
Beech	791	3	0	0	0	794
Paper birch	6,272	69	0	0	0	6,341
Yellow birch	3,592	166	0	0	0	3,758
Cottonwood	1,109	0	6	2	0	1,117
Elm	45,362	491	0	30	0	45,883
Hickory	1,608	0	31	0	0	1,639
Hard maple	34,816	1,138	28	0	0	35,982
Soft maple	11,415	65	18	0	0	11,498
Red oak	69,289	69	321	100	0	69,779
White oak	17,325	2	140	80	0	17,547
Walnut	237	0	12	344	289	882
Other hardwoods	877	0	10	3	12	902
Total	267,494	2,348	726	569	301	271,438
All species [1]	329,483	3,607	726	569	301	334,686

[1]International ¼-inch rule.

Table 11.—*Lake States saw log production by county and species, 1975*

(In thousand board feet)[1]

MICHIGAN

UNIT AND COUNTY	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD	BEECH	WHITE BIRCH
E. UPPER PENINSULA														
ALGER	50	11	204	35	99	895	75	0	4	100	0	220	4785	35
CHIPPEWA	113	60	145	90	157	498	70	0	43	780	0	206	282	132
DELTA	173	13	24	51	232	323	26	0	0	318	0	278	51	110
LUCE	81	40	340	950	546	1786	103	0	173	881	0	359	3793	298
MACKINAC	32	54	200	18	184	889	180	0	133	2485	343	276	541	523
MENOMINEE	581	12	534	12	185	828	11	0	7	827	24	405	57	934
SCHOOLCRAF	0	13	232	56	599	832	7	0	28	193	0	118	268	148
UNIT TOTAL	1329	203	1728	1212	2002	6051	472	0	388	5584	367	1862	9777	2180
W. UPPER PENINSULA														
BARAGA	35	47	3195	106	247	1317	430	0	52	2452	0	307	0	108
DICKINSON	449	125	2	36	248	666	118	0	6	639	9	310	2	275
GOGEBIC	405	17	3915	100	88	838	232	0	602	5049	0	1038	0	1238
HOUGHTON	34	15	708	24	179	1413	90	0	39	3664	0	468	0	663
IRON	38	241	687	54	174	987	150	0	125	2062	0	1005	0	533
KEWEENAW	0	5	8	3	4	317	63	0	0	44	0	149	0	1
MARQUETTE	184	107	1779	314	363	1702	220	0	41	380	0	198	736	128
ONTONAGON	3	16	265	63	70	449	114	0	200	6450	0	307	0	1106
UNIT TOTAL	1148	573	10549	700	1373	7689	1417	0	1065	20740	9	3782	738	4052
N. LOWER PENINSULA														
ALCONA	10	0	0	75	80	80	0	0	263	2725	250	108	15	63
ALPENA	0	0	0	250	250	100	0	0	22	1474	0	47	0	22
ANTRIM	0	0	40	5	105	115	0	0	40	1290	0	490	205	65
ARENAC	0	0	0	0	250	275	0	0	50	1025	0	75	20	150
BAY	0	0	0	0	0	0	0	0	2	0	0	7	6	0
BENZIE	0	0	0	0	0	10	0	0	115	145	0	135	50	3
CHARLEVOIX	0	0	30	5	0	10	0	0	64	450	0	335	186	25
CHEBOYGAN	0	5	234	0	10	27	0	0	3	2498	0	131	86	203
CLARE	0	0	0	0	0	0	0	0	25	1465	0	0	10	60
CRAWFORD	0	0	0	701	520	448	0	0	0	853	0	0	0	35
EMMET	0	0	0	0	25	25	0	0	101	468	0	207	139	60
GLADWIN	0	0	0	25	25	50	0	0	0	1900	0	150	10	110
GRAND TRAV	0	0	0	0	0	0	0	0	0	0	0	25	0	0
IOSCO	0	0	0	0	30	50	0	0	0	1000	0	50	0	0
ISABELLA	0	0	0	0	180	95	0	0	25	600	0	45	50	200
KALKASKA	0	0	10	25	100	180	0	0	0	743	0	30	8	0
LAKE	0	0	10	250	270	20	0	0	0	385	25	58	0	0
LEELANAU	0	0	40	0	0	0	0	0	209	477	0	274	506	0
MANISTEE	0	0	35	0	45	80	0	0	25	195	0	85	25	2
MASON	0	0	10	0	20	40	0	0	60	92	0	107	50	5
MECOSTA	0	0	0	0	0	0	0	0	36	216	0	0	58	0
MIDLAND	0	0	0	0	0	0	0	0	25	325	0	0	0	0
MISSAUKEE	0	0	0	0	58	115	0	0	6	881	0	68	156	20
MONTMORENC	0	0	0	115	150	171	0	0	20	1897	0	327	89	139
NEWAYGO	0	0	0	0	0	245	0	0	94	785	0	100	201	3
OCEANA	0	0	27	0	0	30	0	0	82	150	0	227	152	4
OGEMAW	0	0	0	325	485	28	0	0	75	2415	0	75	10	285
OSCEOLA	0	0	208	0	0	125	0	0	56	1897	0	57	214	14
OSCODA	0	0	0	2060	310	310	0	0	0	2243	0	150	25	35
OTSEGO	0	0	0	0	21	10	0	0	2	838	0	188	30	47
PRESQUE IS	6	0	0	0	0	92	0	0	3	1144	0	124	48	3
ROSCOMMON	0	0	50	768	526	254	0	0	87	3615	0	102	16	235
WEXFORD	0	0	0	0	0	0	0	0	62	287	0	118	52	13
UNIT TOTAL	16	0	654	4604	3460	2837	0	0	157	34478	275	3895	2417	1771
S. LOWER PENINSULA														
ALLEGAN	0	0	0	0	0	48	0	0	227	35	0	124	27	0
BARRY	0	0	0	0	0	0	0	0	262	88	0	259	239	0
BERRIEN	0	0	0	0	0	0	0	0	61	0	0	45	66	0
BRANCH	0	0	0	0	0	0	0	0	158	1	100	56	104	0
CALHOUN	0	0	0	0	0	0	0	0	339	21	100	109	199	0
CASS	0	0	0	0	0	0	0	0	105	1	0	34	71	0
CLINTON	0	0	0	0	0	0	0	0	386	53	0	245	238	0
EATON	0	0	0	0	0	0	0	0	56	0	0	52	51	0
GENESSEE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRATIOT	0	0	0	0	0	0	0	0	106	80	0	76	142	0
HILLSDALE	0	0	0	0	0	0	0	0	10	0	0	0	0	0
HURON	0	0	0	0	0	0	0	0	270	500	0	140	20	100
INGHAM	0	0	0	0	0	0	0	0	201	50	0	200	100	0
IONIA	0	0	0	0	0	0	0	0	258	42	0	259	388	0
JACKSON	0	0	0	0	0	0	0	0	50	0	0	40	20	0
MACOMB	0	0	0	0	0	0	0	0	70	6	0	64	53	0
KENT	0	0	0	0	0	60	0	0	361	28	0	181	247	0
LAPEER	0	0	1	0	0	0	0	0	150	29	0	69	109	1
LENAWEE	0	0	0	0	0	0	0	0	144	0	0	124	62	0
LIVINGSTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MACOMB	0	0	0	0	0	0	0	0	48	15	0	50	0	0
MONROE	0	0	0	0	0	0	0	0	97	0	0	124	62	0
MONTCALM	0	0	0	0	0	20	0	0	114	0	0	87	45	0
MUSKEGON	0	0	0	0	0	7	0	0	0	0	0	7	7	0
OAKLAND	0	0	0	0	0	0	0	0	163	28	0	129	104	0
OTTAWA	0	0	0	0	0	0	0	0	37	0	0	30	135	0
SAGINAW	0	0	0	0	0	0	0	0	221	153	0	150	162	0
ST.CLAIR	0	0	50	0	0	250	0	0	152	35	0	100	0	0
ST.JOSEPH	0	0	0	0	0	0	0	0	53	3	0	20	21	0
SANILAC	0	0	0	0	0	0	0	0	20	100	0	0	0	0
SHIAWASSEE	0	0	0	0	0	0	0	0	101	0	0	40	62	0
TUSCOLA	0	0	0	0	0	0	0	0	138	1110	0	60	152	0
VAN BUREN	0	0	0	0	0	25	0	0	85	0	0	56	97	0
WASHTENAW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WAYNE	0	0	0	0	0	0	0	0	35	0	0	25	0	0
UNIT TOTAL	0	0	51	0	0	412	0	0	4473	2378	200	2955	2983	101
STATE TOTAL	2501	776	12990	7926	6835	16989	1897	0	7503	63180	851	12494	15915	8104

(TABLE 11 CONTINUED ON NEXT PAGE)

UNIT AND COUNTY	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARD-WOODS	ALL SPECIES
E. UPPER PENINSULA											
ALGER	542	0	384	0	9043	1098	0	0	0	92	17672
CHIPPEWA	232	0	379	0	1723	216	26	17	0	2	5171
DELTA	120	0	294	0	343	121	0	0	0	0	2526
LUCE	773	0	507	0	7282	1329	0	56	0	82	19379
MACKINAC	441	0	1167	0	2810	669	4	28	0	22	11289
MENOMINEE	129	0	1722	0	2025	555	116	0	0	2	8966
SCHOOLCRAF	261	0	418	0	1145	187	0	11	0	0	4516
UNIT TOTAL	2498	0	4871	0	24371	4175	146	112	0	200	69519
W. UPPER PENINSULA											
BARAGA	1619	0	985	0	10057	1076	150	0	0	8	22189
DICKINSON	118	0	1164	0	590	97	50	0	0	0	4904
GOGEBIC	2398	0	1195	0	11731	1245	380	0	0	7	30498
HOUGHTON	788	0	334	0	8114	724	408	0	0	1	17666
IRON	895	0	1243	0	5443	267	68	2	0	46	14028
KEWEENAW	369	0	4	0	1900	342	366	0	0	0	3575
MARQUETTE	510	0	475	0	6043	553	1048	0	0	38	14819
ONTONAGON	690	0	503	0	3126	398	195	0	0	4	13949
UNIT TOTAL	7387	0	5903	0	47004	4702	2665	2	0	104	121628
N. LOWER PENINSULA											
ALCONA	0	10	23	0	58	367	756	50	0	0	4933
ALPENA	0	0	22	0	22	389	109	0	0	0	2707
ANTRIM	10	0	475	25	600	180	180	0	2	0	3847
ARENAC	25	500	0	0	50	500	315	10	0	0	3245
BAY	0	259	0	0	9	3	135	80	0	0	506
BENZIE	0	0	0	125	295	65	0	10	0	0	953
CHARLEVOIX	1	40	143	25	586	130	30	0	0	0	2060
CHEBOYGAN	6	0	632	0	188	568	188	0	0	0	4563
CLARE	0	0	25	0	0	155	350	25	0	0	2115
CRAWFORD	0	0	0	0	13	36	1132	5	0	0	3248
EMMET	1	120	316	0	364	26	143	0	0	0	1965
GLADWIN	25	475	0	0	92	1137	1245	0	0	0	5244
GRAND TRAV	0	0	0	0	100	0	0	0	0	0	125
IOSCO	0	0	0	0	50	125	320	10	0	0	1615
ISABELLA	0	0	0	0	320	160	420	50	0	0	2145
KALKASKA	0	0	145	0	25	0	769	0	0	0	2035
LAKE	0	0	45	0	160	150	1139	249	0	0	2761
LEELANAU	50	0	126	0	1039	50	0	0	0	0	2776
MANISTEE	0	0	10	100	395	135	500	10	0	0	1642
MASON	0	0	23	225	313	259	937	325	0	7	2473
MECOSTA	0	0	0	0	58	58	72	0	0	0	498
MIDLAND	50	550	25	0	25	185	365	25	0	0	1575
MISSAUKEE	0	0	150	0	174	200	1203	14	0	0	3045
MONTMORENC	25	50	290	50	172	835	620	0	0	0	5050
NEWAYGO	5	7	0	0	789	413	3923	98	0	10	6680
OCEANA	26	3	75	128	1028	605	2283	285	0	207	5312
OGEMAW	25	230	25	0	116	433	2012	20	0	0	6766
OSCEOLA	7	0	14	0	928	403	931	132	0	0	4986
OSCODA	0	0	40	0	70	290	1813	13	0	0	8879
OTSEGO	0	0	266	0	80	202	103	50	0	0	1879
PRESQUE IS	6	0	357	0	66	364	46	0	0	0	2354
ROSCOMMON	25	150	25	0	165	335	5051	10	0	0	11384
WEXFORD	13	0	0	0	393	31	137	50	0	0	1156
UNIT TOTAL	300	2394	3252	678	8743	8789	27227	1521	2	224	110522
S. LOWER PENINSULA											
ALLEGAN	3	0	0	0	335	41	400	7	0	20	1260
BARRY	0	104	1	96	493	462	1818	545	29	29	4425
BERRIEN	0	19	3	8	167	115	571	99	16	19	1189
BRANCH	0	2	0	1	224	111	224	13	11	11	1016
CALHOUN	0	44	0	118	357	448	1044	304	15	44	3142
CASS	0	13	3	4	173	116	651	107	15	28	1321
CLINTON	0	173	0	119	576	570	1118	624	50	28	4182
EATON	0	0	0	0	124	52	104	0	1	0	440
GENESSEE	0	0	0	0	0	0	0	0	8	0	8
GRATIOT	0	176	264	50	68	312	594	307	0	0	2175
HILLSDALE	0	0	0	10	10	20	40	10	0	0	100
HURON	0	710	0	20	600	120	200	200	20	0	2900
INGHAM	0	54	0	50	200	205	330	210	50	0	1650
IONIA	0	50	0	94	471	401	674	247	104	0	2988
JACKSON	0	60	0	20	100	100	200	200	20	0	810
KALAMAZOO	0	3	1	13	174	85	176	21	11	20	697
KENT	0	107	0	102	779	523	1705	598	0	68	4759
LAPEER	0	100	0	35	281	356	911	536	1	28	2609
LENAWEE	0	85	31	117	136	195	348	224	62	0	1528
LIVINGSTON	0	10	0	0	10	20	30	0	30	0	100
MACOMB	0	55	0	25	10	65	120	15	45	0	448
MONROE	0	55	16	117	124	144	236	174	31	0	1180
MONTCALM	2	19	1	0	222	142	365	67	0	0	1084
MUSKEGON	0	0	0	0	14	68	168	178	0	7	456
OAKLAND	0	69	124	122	463	345	893	452	67	28	2987
OTTAWA	3	1	0	3	62	142	281	55	0	6	755
SAGINAW	50	427	264	70	155	753	778	570	23	0	3776
ST.CLAIR	0	135	0	0	80	160	210	40	45	0	1257
ST.JOSEPH	0	10	3	12	57	107	237	105	11	38	677
SANILAC	0	165	0	1	10	110	40	5	30	2	483
SHIAWASSEE	0	83	0	20	100	140	205	244	20	0	1015
TUSCOLA	0	969	264	20	119	264	394	241	20	0	3751
VAN BUREN	0	22	6	10	194	210	592	113	22	33	1465
WASHTENAW	0	0	0	0	0	0	0	0	0	0	0
WAYNE	0	30	174	50	150	20	350	50	50	0	934
UNIT TOTAL	58	3750	1155	1307	7038	6922	16007	6561	807	409	57567
STATE TOTAL	10243	6144	15181	1985	87156	24588	46045	8196	809	937	359236

(TABLE 11 CONTINUED ON NEXT PAGE)

UNIT AND COUNTY	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD	BEECH	WHITE BIRCH
NORTHERN ASPEN-BIRCH														
CARLTON	1	60	0	411	141	51	6	0	10	298	0	0	0	23
COOK	209	188	0	240	4	2333	477	0	38	2482	0	0	0	380
KOOCHICH.	3484	599	0	1214	274	274	547	1	312	4693	583	131	0	131
LAKE	25	73	0	3536	325	2191	150	0	76	798	0	0	0	426
ST.LOUIS	1388	1093	0	7686	1431	1663	527	2	48	4833	0	2	0	28
UNIT TOTAL	4109	1153	0	12673	2965	6512	1707	3	484	13104	583	133	0	988
NORTHERN PINE														
AITKIN	5	36	0	314	189	277	5	0	1248	6065	0	295	0	289
BECKER	0	7	0	1519	234	383	32	8	97	524	0	265	0	56
BELTRAMI	165	16	0	1963	1133	1081	3	0	108	2149	91	339	0	120
CASS	55	178	0	2011	2861	272	21	0	33	4126	0	65	0	100
CLEARWATER	0	1	0	858	272	58	28	0	0	1826	0	25	0	100
CROW WING	0	5	0	1097	595	59	0	0	508	2600	0	356	0	242
HUBBARD	3	1	0	1212	140	208	1	0	0	344	0	0	0	0
ITASCA	32	670	0	3886	1919	1586	1064	0	382	14453	105	346	0	660
LAKE-WOODS	210	13	0	1086	95	94	172	31	0	444	0	0	0	0
MAHNOMEN	0	0	0	412	100	55	0	0	0	640	0	10	0	25
ROSEAU	0	3	0	2240	0	0	93	31	0	36	0	0	0	0
WADENA	2	24	0	1156	795	60	0	0	48	228	0	127	0	23
UNIT TOTAL	472	956	0	16774	8333	4633	1424	70	2424	33435	196	1828	0	1615
CENTRAL HARDWOODS														
ANOKA	1	0	0	0	0	0	0	0	7	30	0	3	0	2
BENTON	1	0	0	0	0	1	0	0	0	50	0	6	0	1
CARVER	0	0	0	0	0	0	0	0	50	0	0	40	0	0
CHISAGO	0	0	0	0	0	0	0	0	7	30	0	3	0	1
DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOUGLAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FILLMORE	2	0	0	0	0	2	0	0	120	20	240	349	0	1
GOODHUE	0	0	0	0	0	0	0	0	68	0	0	192	0	0
HENNEPIN	1	0	0	0	0	0	0	0	0	0	0	0	0	0
HOUSTON	0	0	0	0	0	1	0	0	5	93	240	86	0	8
ISANTI	2	0	0	0	0	0	0	0	2	6	0	1	0	0
KANABEC	0	0	0	0	3	0	0	0	32	711	0	0	0	11
LE SUEUR	3	0	0	0	0	0	0	0	48	0	0	139	0	0
MILLE LACS	0	0	0	0	0	2	0	0	106	1049	0	274	0	28
MURRISON	3	0	0	21	48	12	0	0	17	112	0	122	0	0
OLMSTED	0	0	0	0	0	0	0	0	19	0	0	64	0	0
OTTER TAIL	1	1	0	134	5	6	8	6	93	333	0	250	0	31
PINE	1	2	0	184	123	43	3	0	0	80	0	0	0	7
RAMSEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RICE	1	1	0	0	0	0	0	0	21	0	0	71	0	0
SCOTT	0	0	0	0	0	0	0	0	50	0	0	30	0	0
SHERBURNE	1	1	0	0	0	0	0	0	17	0	0	0	0	0
STEARNS	0	0	0	0	0	0	0	0	91	142	10	199	0	6
TODD	0	0	0	136	100	0	0	0	58	113	0	95	0	17
WABASHA	0	0	0	0	0	0	0	0	9	79	0	37	0	6
WASHINGTON	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WINONA	0	0	0	0	0	0	0	0	22	16	0	106	0	6
WRIGHT	0	0	0	0	0	0	0	0	4	82	0	48	0	0
UNIT TOTAL	16	12	0	474	279	127	11	6	831	2946	490	2130	0	125
PRAIRIE														
BIG STONE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLUE EARTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROWN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHIPPEWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COTTONWOOD	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DODGE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FARIBAULT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FREEBORN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACKSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KANDIYOHI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KITTSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAC QUI PA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LINCOLN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LYON	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLEOD	0	0	0	0	0	0	0	0	60	8	0	84	0	0
MARSHALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARTIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEEKER	0	0	0	0	0	0	0	0	63	8	0	45	0	0
MOWER	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MURRAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NICOLLET	0	0	0	0	0	0	0	0	36	0	0	104	0	0
NOBLES	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NORMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIPESTONE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLK	1	0	0	0	0	0	0	0	39	0	0	0	0	0
POPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RED LAKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REDWOOD	0	0	0	0	0	0	0	0	0	0	0	5	0	0
RENVILLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIBLEY	1	0	0	0	0	0	0	0	0	0	0	0	0	0
STEELE	0	0	0	0	0	0	0	0	5	0	0	15	0	0
STEVENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SWIFT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRAVERSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASECA	0	0	0	0	0	0	0	0	17	0	0	35	0	1
WATONWAN	1	1	0	0	0	0	0	0	1	0	0	0	0	0
YELLOW MEDICINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIT TOTAL	0	0	0	0	0	0	0	0	219	16	0	288	0	0
STATE TOTAL	4589	2100	0	29956	10680	11272	3145	79	3954	49501	1269	4369	0	2728

(TABLE 11 CONTINUED ON NEXT PAGE)

(TABLE 11 CONTINUED)

MINNESOTA

UNIT AND COUNTY	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARD-WOODS	ALL SPECIES
NORTHERN ASPEN-BIRCH											
CARLTON	0	0	11	0	4	0	96	0	0	0	1112
COOK	0	0	0	0	0	0	0	0	0	0	6351
KOOCHICH.	0	0	520	0	0	0	0	0	0	0	12803
LAKE	0	0	0	0	0	0	0	0	0	0	7832
ST.LOUIS	0	0	15	0	0	0	1	0	0	0	16033
UNIT TOTAL	0	0	546	0	4	0	97	0	0	0	44131
NORTHERN PINE											
AITKIN	0	0	363	0	45	125	589	80	0	0	9925
BECKER	0	0	390	0	50	0	310	197	0	0	4072
BELTRAMI	0	0	226	0	20	0	116	0	0	0	7530
CASS	0	0	4	0	0	0	302	50	0	0	11078
CLEARWATER	0	0	470	0	20	0	140	260	0	0	4058
CROW WING	0	0	222	0	40	81	860	239	0	0	6904
HUBBARD	0	0	0	0	0	0	0	0	0	0	2411
ITASCA	0	0	1274	0	0	50	75	0	0	0	23609
LAKE-WOODS	0	0	0	0	0	0	0	0	0	0	2150
MAHNOMEN	0	0	0	0	10	0	15	5	0	0	1172
ROSEAU	0	0	0	0	0	0	0	0	0	0	2313
WADENA	0	0	193	0	25	0	160	93	0	0	2933
UNIT TOTAL	0	0	3142	0	210	256	2567	924	0	0	78155
CENTRAL HARDWOODS											
ANOKA	0	15	43	0	0	0	43	22	0	0	170
BENTON	0	3	11	0	2	0	83	56	0	0	220
CARVER	0	0	100	0	30	0	10	75	0	0	305
CHISAGO	0	0	23	0	3	3	50	22	0	0	142
DAKOTA	0	0	0	0	0	0	0	0	0	0	0
DOUGLAS	0	0	0	0	0	0	0	0	0	0	0
FILLMORE	0	53	775	32	276	2	2937	906	11	1	5727
GOODHUE	0	109	240	0	48	93	311	61	48	48	1218
HENNEPIN	0	0	300	0	0	0	0	0	0	0	300
HOUSTON	0	75	479	40	2	31	3674	436	33	23	5246
ISANTI	0	0	61	0	0	0	16	44	0	0	130
KANABEC	0	222	39	0	0	22	250	28	0	0	1305
LE SUEUR	0	35	139	0	69	21	101	45	13	0	600
MILLE LACS	0	100	583	0	0	39	403	58	0	0	2662
MORRISON	0	0	2	0	12	6	60	33	0	0	795
OLMSTED	0	15	60	0	12	12	244	89	7	8	541
OTTER TAIL	0	0	362	0	41	0	349	149	0	0	1692
PINE	0	0	2	0	0	0	42	0	0	0	524
RAMSEY	0	0	0	0	0	0	0	0	0	0	0
RICE	0	8	82	6	25	14	274	83	21	6	371
SCOTT	0	0	7	0	20	0	62	25	0	0	185
SHERBURNE	0	0	81	0	0	18	64	28	2	0	217
STEARNS	0	16	320	0	22	11	84	62	0	0	970
TODD	0	0	201	0	18	17	173	78	0	0	1065
WABASHA	0	27	47	2	19	43	467	151	2	0	894
WASHINGTON	0	0	0	0	0	0	0	0	0	0	0
WINONA	0	6	195	4	33	34	1948	609	61	18	3158
WRIGHT	0	12	17	0	2	0	2	3	0	0	170
UNIT TOTAL	0	787	4115	78	654	396	11514	3073	201	104	28607
PRAIRIE											
BIG STONE	0	0	0	0	0	0	0	0	0	0	0
BLUE EARTH	0	0	0	0	0	0	0	0	0	0	0
BROWN	0	0	0	0	0	0	0	0	5	0	5
CHIPPEWA	0	110	0	0	0	0	0	0	0	0	110
CLAY	0	222	0	0	0	0	0	0	0	0	222
COTTONWOOD	0	0	0	0	0	0	0	0	0	0	0
DODGE	0	0	0	0	0	0	0	0	0	0	0
FARIBAULT	0	414	0	0	0	0	0	0	0	0	414
FREEBORN	0	0	0	0	0	0	0	0	0	0	0
GRANT	0	0	0	0	0	0	0	0	0	0	0
JACKSON	0	0	0	0	0	0	0	0	0	0	0
KANDIYOHI	0	2	0	0	0	0	0	0	0	0	2
KITTSON	0	0	0	0	0	0	0	0	0	0	0
LAC QUI PA	0	0	0	0	0	0	0	0	0	0	0
LINCOLN	0	0	0	0	0	0	0	0	0	0	0
LYON	0	0	0	0	0	0	0	0	0	0	0
MCLEOD	0	640	852	0	1	60	24	36	0	0	1765
MARSHALL	0	0	0	0	0	0	0	40	0	0	40
MARTIN	0	0	0	0	0	0	0	0	0	0	0
MEEKER	0	308	438	0	0	40	36	52	0	0	990
MOWER	0	0	0	0	0	0	0	0	0	0	0
MURRAY	0	0	0	0	0	0	0	0	0	0	0
NICOLLET	0	26	104	0	44	16	76	34	10	0	450
NOBLES	0	0	0	0	0	0	0	0	0	0	0
NORMAN	0	155	0	0	0	0	0	0	0	0	155
PENNINGTON	0	0	0	0	0	0	0	0	0	0	0
PIPESTONE	0	0	0	0	0	0	0	0	0	0	0
POLK	0	389	244	0	0	0	0	0	0	0	672
POPE	0	0	0	0	0	0	0	0	0	0	0
RED LAKE	0	0	0	0	0	0	0	0	0	0	0
REDWOOD	0	10	15	0	0	5	0	0	17	0	50
RENVILLE	0	10	0	0	0	0	0	0	0	0	10
ROCK	0	0	0	0	0	0	0	0	0	0	0
SIBLEY	0	0	0	0	0	0	0	0	0	0	0
STEELE	0	4	17	0	6	3	16	7	2	0	75
STEVENS	0	0	0	0	0	0	0	0	0	0	0
SWIFT	0	100	0	0	0	0	0	0	0	0	100
TRAVERSE	0	0	0	0	0	0	0	0	0	0	0
WASECA	0	9	35	0	15	5	25	21	3	0	160
WATONWAN	0	0	0	0	0	0	0	0	0	0	0
WILKIN	0	0	0	0	0	0	0	0	0	0	0
Y.MEDICINE	0	10	0	0	0	0	0	0	0	0	10
UNIT TOTAL	0	2409	1705	0	66	129	177	190	35	0	5230
STATE TOTAL	0	3196	9508	78	934	781	14355	4187	236	104	156123

(TABLE 11 CONTINUED ON NEXT PAGE)

(TABLE 11 CONTINUED)

WISCONSIN

UNIT AND COUNTY	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMA-RACK	ASH	ASPEN	BALSAM POPLAR	BASS-WOOD	BEECH	WHITE BIRCH
NORTHEASTERN														
FLORENCE	12	12	145	2	72	404	16	0	11	831	0	519	0	313
FOREST	510	23	1958	162	569	1983	71	0	81	3824	0	1071	0	495
LANGLADE	15	5	99	66	62	383	5	0	128	723	0	514	0	119
LINCOLN	6	11	89	13	97	500	0	0	271	938	0	385	0	160
MARINETTE	75	0	48	176	476	647	0	0	49	2285	19	182	3	202
OCONTO	120	7	66	2	420	481	22	3	340	4638	71	116	57	133
ONEIDA	89	98	81	382	912	1560	28	0	41	2531	0	180	0	589
SHAWANO	679	26	2443	7	99	4956	25	0	767	3532	0	2120	256	936
VILAS	28	99	197	867	1848	4125	81	0	13	6197	0	267	0	1308
UNIT TOTAL	1534	281	5126	1677	4555	15039	248	3	1701	25499	90	5354	316	4255
NORTHWESTERN														
ASHLAND	0	390	47	447	1295	2327	463	5	45	2032	0	301	0	50
BARRON	0	0	0	1	32	341	0		121	532	0	373	0	12
BAYFIELD	13	478	62	1006	1189	3782	347	5	11	1471	0	123	0	115
BURNETT	0	0	0	124	77	180	0	0	15	152	0	55	0	0
DOUGLAS	0	59	0	1144	1402	957	356	0	0	561	0	10	0	10
IRON	53	440	175	123	531	1809	232	0	72	759	0	295	0	158
POLK	0	0	0	0	26	159	0	0	100	420	0	328	0	31
PRICE	0	263	234	364	1285	1801	432	5	203	2101	0	295	0	138
RUSK	0	1	0	0	41	207	0	0	174	1955	0	443	0	256
SAWYER	0	8	0	73	596	2633	0	0	256	5044	0	650	0	444
TAYLOR	0	0	0	0	0	6	0	0	121	537	0	356	0	71
WASHBURN	0	0	0	51	59	28	0	0	24	2737	0	689	0	5
UNIT TOTAL	66	1639	518	3333	6533	14230	1830	15	1142	18301	0	3918	0	1290
CENTRAL														
ADAMS	0	0	0	0	16	183	0	0	10	67	0	22	0	13
CHIPPEWA	0	0	0	0	55	215	0	0	6	1319	0	713	0	32
CLARK	0	0	1	1	19	731	0	0	190	1102	0	505	0	41
EAU CLAIR	0	0	0	0	0	50	0	0	0	12	0	49	0	6
JACKSON	0	0	0	0	36	189	0	0	4	64	0	126	0	10
JUNEAU	0	0	0	0	40	69	0	0	78	184	0	87	0	23
MARATHON	0	4	273	4	39	406	3	0	481	586	0	1558	0	38
MARQUETTE	0	0	0	0	48	77	0	0	5	8	0	1	0	2
MONROE	0	0	0	0	5	30	0	0	52	181	0	234	0	25
PORTAGE	0	0	0	0	11	132	0	0	30	110	0	172	0	5
WAUPACA	0	24	62	5	34	1049	25	0	271	28	0	424	27	3
WAUSHARA	5	0	4	30	226	524	0	0	53	0	0	100	0	5
WOOD	0	0	0	0	2	98	0	0	78	85	0	129	0	2
UNIT TOTAL	5	28	340	40	531	3753	28	0	1258	3746	0	4120	27	205

(TABLE 11 CONTINUED ON NEXT PAGE)

(TABLE 11 CONTINUED)

WISCONSIN

UNIT AND COUNTY	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMARACK	ASH	ASPEN	BALSAM POPLAR	BASSWOOD	BEECH	WHITE BIRCH
SOUTHWESTERN														
BUFFALO	0	0	0	0	0	20	0	0	4	643	0	472	0	306
CRAWFORD	0	0	0	0	1	28	0	0	108	173	0	285	0	10
DUNN	0	0	0	0	25	65	0	0	120	85	0	605	0	5
GRANT	0	0	0	0	3	10	0	0	63	115	0	163	0	0
IOWA	0	0	0	0	0	0	0	0	42	47	0	101	0	2
LACROSSE	0	0	0	0	0	0	0	0	20	51	0	158	0	14
LAFAYETTE	0	0	0	0	0	0	0	0	6	85	0	31	0	0
PEPIN	0	0	0	0	0	0	0	0	10	10	0	108	0	5
PIERCE	0	0	0	0	0	40	0	0	60	60	0	602	0	5
RICHLAND	0	0	0	0	0	0	0	0	62	156	0	514	0	12
ST.CROIX	0	0	0	0	25	50	0	0	41	21	0	194	0	11
SAUK	0	0	0	0	0	5	0	0	163	458	0	411	0	6
TREMPEALEU	0	0	0	0	10	30	0	0	8	90	0	165	0	19
VERNON	0	0	0	0	0	26	0	0	164	47	0	980	0	11
UNIT TOTAL	0	0	0	0	64	274	0	0	871	2041	0	4789	0	406
SOUTHEASTERN														
BROWN	31	0	16	0	4	77	0	0	73	67	32	147	147	37
CALUMET	4	0	0	0	0	10	0	0	50	3	0	25	0	31
COLUMBIA	0	0	0	0	10	10	0	0	23	33	0	121	0	2
DANE	0	0	0	0	0	0	0	0	0	0	0	5	0	0
DODGE	0	0	0	0	0	0	0	0	19	11	0	27	0	0
DOOR	40	0	14	0	5	23	0	0	33	46	22	32	33	54
FOND DULAC	0	0	0	0	0	5	0	0	1	0	0	6	0	0
GREEN	0	0	0	0	0	4	0	0	12	36	0	5	0	0
GREEN LAKE	0	0	0	0	17	53	0	0	65	10	0	62	0	0
JEFFERSON	0	0	0	0	0	0	0	0	16	0	0	10	0	0
KENOSHA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KEWAUNEE	8	0	10	0	2	63	0	0	61	38	43	85	114	43
MANITOWOC	3	0	55	0	0	250	0	0	233	90	11	236	103	7
MILWAUKEE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OUTAGAMIE	3	0	0	0	7	693	0	0	165	123	5	189	37	5
OZAUKEE	0	0	0	0	0	0	0	0	3	0	0	0	0	0
RACINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SHEBOYGAN	7	0	0	0	0	38	0	0	82	13	0	24	17	0
WALWORTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	0	0	0	0	0	0	0	0	12	0	0	15	0	0
WAUKESHA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINNEBAGO	10	0	0	0	0	86	0	0	46	4	5	11	0	6
UNIT TOTAL	106	0	95	0	45	1312	0	0	894	474	118	1000	451	185
STATE TOTAL	1711	1948	6079	5050	11728	34608	2106	18	5866	50061	208	19181	794	6341

(TABLE 11 CONTINUED ON NEXT PAGE)

(TABLE 11 CONTINUED)

WISCONSIN

UNIT AND COUNTY	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARD-WOODS	ALL SPECIES
NORTHEASTERN											
FLORENCE	139	0	1186	0	2613	34	71	0	0	46	6426
FOREST	827	0	1927	0	4816	161	75	0	4	87	18644
LANGLADE	130	0	1981	5	2301	117	117	0	0	100	6870
LINCOLN	129	0	1938	0	1150	302	241	8	0	0	6238
MARINETTE	22	0	1247	1	433	203	707	275	0	0	7050
OCONTO	49	32	2004	2	675	394	851	243	0	0	10726
ONEIDA	125	0	480	0	406	80	341	24	0	0	7947
SHAWANO	822	0	11101	164	6077	1149	3103	321	0	144	38727
VILAS	71	0	75	0	390	37	407	2	0	6	16018
UNIT TOTAL	2314	32	21939	172	18861	2477	5913	873	4	383	118646
NORTHWESTERN											
ASHLAND	165	0	182	0	299	75	50	1	0	0	8174
BARRON	2	0	395	0	833	66	1822	347	0	0	4677
BAYFIELD	37	0	41	0	222	28	174	2	0	0	9106
BURNETT	0	0	60	2	51	50	1004	0	65	0	1835
DOUGLAS	0	0	10	0	16	0	3	0	0	0	4528
IRON	227	0	288	0	830	114	179	1	0	0	6286
POLK	0	14	201	5	355	76	1788	441	30	0	3974
PRICE	148	0	1434	0	602	199	258	3	0	0	9765
RUSK	63	0	600	0	725	242	766	25	0	0	5498
SAWYER	119	0	385	0	503	74	253	4	0	0	11042
TAYLOR	95	0	1068	0	483	259	249	21	0	0	3266
WASHBURN	0	0	5	0	10	12	352	10	0	0	3982
UNIT TOTAL	856	14	4669	7	4729	1195	6898	855	95	0	72133
CENTRAL											
ADAMS	5	2	69	1	21	61	566	47	0	4	1087
CHIPPEWA	50	0	621	0	300	184	537	40	0	0	4072
CLARK	128	0	1358	0	469	246	1547	781	0	0	7119
EAU CLAIR	12	0	0	0	50	12	162	0	0	0	353
JACKSON	1	30	243	5	154	303	1803	233	0	1	3202
JUNEAU	8	5	163	1	79	158	1460	348	0	6	2709
MARATHON	281	0	6064	25	3312	922	1867	241	0	106	16210
MARQUETTE	0	10	29	0	24	88	882	140	0	0	1314
MONROE	5	21	390	32	261	314	3281	700	0	5	5536
PORTAGE	0	0	332	5	108	133	825	55	0	4	1922
WAUPACA	60	0	1685	37	1165	572	1442	263	0	107	7283
WAUSHARA	0	0	161	4	56	129	461	203	0	3	1964
WOOD	4	0	451	0	33	67	932	93	0	4	1978
UNIT TOTAL	554	68	11566	110	6032	3189	15765	3144	0	240	54749

(TABLE 11 CONTINUED ON NEXT PAGE)

(TABLE 11 CONTINUED)

WISCONSIN

UNIT AND COUNTY	YELLOW BIRCH	COTTON-WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	WALNUT	OTHER HARD-WOODS	ALL SPECIES
SOUTHWESTERN											
BUFFALO	0	90	376	704	41	731	9565	1406	0	10	14368
CRAWFORD	0	74	361	23	358	204	3596	1527	182	43	6973
DUNN	0	15	378	13	391	45	1260	295	0	20	3322
GRANT	0	44	203	22	218	124	1587	1011	104	15	3681
IOWA	3	12	148	6	152	61	900	527	106	2	2109
LACROSSE	0	169	476	174	156	433	3435	822	39	1	5948
LAFAYETTE	0	0	0	12	11	11	178	54	18	2	408
PEPIN	0	20	48	2	96	0	100	40	0	15	454
PIERCE	0	25	367	20	558	30	347	60	0	15	2189
RICHLAND	3	2	203	16	1074	55	1552	645	55	6	4375
ST.CROIX	5	10	220	10	221	16	219	35	0	5	1083
SAUK	5	145	416	112	510	284	5521	1706	54	5	9801
TREMPEALEU	0	30	207	36	127	97	2825	557	0	0	4201
VERNON	0	18	598	156	1365	260	4620	1158	63	18	9484
UNIT TOTAL	16	654	4021	1306	5278	2351	35705	9843	620	157	68396
SOUTHEASTERN											
BROWN	5	154	334	0	69	189	135	209	1	0	1727
CALUMET	0	7	229	0	12	7	38	72	0	0	488
COLUMBIA	3	12	103	0	118	91	2219	219	2	6	2972
DANE	0	0	20	0	40	10	397	1180	48	7	1707
DODGE	0	25	19	9	11	28	222	110	3	58	542
DOOR	0	0	58	0	60	32	33	1	0	0	486
FOND DULAC	0	5	17	1	9	36	22	18	0	15	135
GREEN	0	0	20	23	14	7	568	91	89	9	878
GREEN LAKE	0	12	78	0	22	180	594	174	0	8	1275
JEFFERSON	0	0	0	0	9	2	43	48	0	0	128
KENOSHA	0	0	0	0	0	0	0	0	0	0	0
KEWAUNEE	0	11	252	0	185	169	24	29	0	0	1137
MANITOWOC	0	37	545	11	256	482	220	180	0	2	2721
MILWAUKEE	0	0	0	0	0	0	0	0	0	0	0
OUTAGAMIE	10	62	1756	0	235	797	860	361	0	0	5308
OZAUKEE	0	0	10	0	0	13	0	0	0	0	26
RACINE	0	0	0	0	0	0	0	0	0	0	0
ROCK	0	0	0	0	0	0	0	0	16	4	20
SHEBOYGAN	0	8	143	0	22	155	79	30	0	9	627
WALWORTH	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	0	11	71	0	15	25	11	16	0	3	179
WAUKESHA	0	0	0	0	0	0	0	0	3	0	3
WINNEBAGO	0	5	33	0	5	63	33	94	1	1	403
UNIT TOTAL	18	349	3688	44	1082	2286	5498	2832	163	122	20762
STATE TOTAL	3758	1117	45883	1639	35982	11498	69779	17547	882	902	334686

[1] International ¼-inch rule.

Table 12.—*Lake States veneer log production by State, species, and area of destination, 1975*
(In thousand board feet)[1]

MICHIGAN

Species	Destination of wood						
	Michigan	Wisconsin	Indiana	Ohio	Kentucky	Canada	Total
SOFTWOODS:							
Cedar	0	0	0	0	0	0	0
Balsam fir	0	0	0	0	0	0	0
Hemlock	0	0	0	0	0	0	0
Jack pine	0	0	0	0	0	0	0
Red pine	0	0	0	0	0	0	0
White pine	0	0	0	0	0	0	0
Spruce	0	0	0	0	0	0	0
Tamarack	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
HARDWOODS:							
Ash	50	141	0	0	5	0	196
Aspen	12,655	9	0	0	0	0	12,664
Balsam poplar	0	0	0	0	0	0	0
Basswood	584	161	21	0	0	0	766
Beech	112	466	0	0	0	116	694
Paper birch	536	397	0	0	7	0	940
Yellow birch	0	2,829	0	0	0	0	2,829
Cottonwood	440	0	0	0	0	0	440
Elm	18	343	0	0	0	0	361
Hickory	28	0	17	0	3	0	48
Hard maple	536	3,467	297	134	25	209	4,668
Soft maple	333	236	0	0	0	0	569
Red oak	229	918	157	0	20	0	1,324
White oak	34	0	94	13	40	0	181
Walnut	0	0	143	64	96	0	303
Other hardwoods	54	35	7	0	0	0	96
Total	15,609	9,002	736	211	196	325	26,079
All species	15,609	9,002	736	211	196	325	26,079

(Table 12 continued on next page)

(Table 12 continued)

MINNESOTA

Species	Destination of Wood							
	Minnesota	Wisconsin	Michigan	Kentucky	Iowa	Canada	Other Countries	Total
SOFTWOODS:								
Cedar	0	0	0	0	0	0	0	0
Balsam fir	0	0	0	0	0	0	0	0
Hemlock	0	0	0	0	0	0	0	0
Jack pine	0	0	0	0	0	0	0	0
Red pine	0	0	0	0	0	0	0	0
White pine	0	0	0	0	0	0	0	0
Spruce	0	0	0	0	0	0	0	0
Tamarack	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0
HARDWOODS:								
Ash	0	17	0	0	0	0	0	17
Aspen	15	0	357	0	0	71	0	443
Balsam poplar	0	0	0	0	0	0	0	0
Basswood	139	278	0	0	0	0	0	417
Beech	0	0	0	0	0	0	0	0
Paper birch	0	190	0	0	0	0	0	190
Yellow birch	0	10	0	0	0	0	10	20
Cottonwood	36	322	0	0	0	0	0	358
Elm	31	292	0	14	0	0	39	376
Hickory	0	0	0	0	0	0	0	0
Hard maple	5	280	0	0	0	0	5	290
Soft maple	92	76	0	0	0	0	0	168
Red oak	78	656	0	0	0	0	17	751
White oak	0	3	0	0	0	0	26	29
Walnut	0	0	0	41	1	0	109	151
Other hardwoods	0	0	0	6	0	0	0	6
Total	396	2,124	357	61	1	71	206	3,216
All species	396	2,124	357	61	1	71	206	3,216

(Table 12 continued on next page)

(Table 12 continued)

WISCONSIN

Species	Destination of wood						
	Wisconsin	Michigan	Indiana	Iowa	Minnesota	Kentucky	Total
SOFTWOODS:							
Cedar	0	0	0	0	0	0	0
Balsam fir	0	0	0	0	0	0	0
Hemlock	0	0	0	0	0	0	0
Jack pine	0	0	0	0	0	0	0
Red pine	0	0	0	0	0	0	0
White pine	18	0	0	0	0	0	18
Spruce	0	0	0	0	0	0	0
Tamarack	0	0	0	0	0	0	0
Total	18	0	0	0	0	0	18
HARDWOODS:							
Ash	482	0	0	0	0	0	482
Aspen	229	10,886	0	0	21	0	11,136
Balsam poplar	0	0	0	0	0	0	0
Basswood	870	0	0	0	51	0	921
Beech	27	0	0	0	0	0	27
Paper birch	272	0	0	0	0	0	272
Yellow birch	820	0	0	0	0	0	820
Cottonwood	117	0	0	0	0	0	117
Elm	3,719	0	0	0	0	6	3,725
Hickory	26	0	0	0	0	4	30
Hard maple	3,444	0	0	0	0	0	3,444
Soft maple	709	0	0	0	26	0	735
Red oak	9,185	0	19	0	0	18	9,222
White oak	440	0	15	0	0	16	471
Walnut	0	0	107	121	0	18	246
Other hardwoods	21	0	5	0	0	0	26
Total	20,361	10,886	146	121	98	62	31,674
All species	20,379	10,886	146	121	98	62	31,692

[1]International ¼-inch rule.

Table 13.—*Lake States veneer log production by county and species, 1975*
(In thousand board feet)[1]

MICHIGAN

Unit and county	Ash	Aspen	Bass-wood	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
E. UPPER PENINSULA:																
Alger	0	0	0	139	25	157	0	21	0	336	6	11	0	0	3	692
Chippewa	0	0	0	80	36	136	0	20	0	259	0	0	0	0	2	533
Delta	0	0	4	64	325	105	0	20	0	212	21	3	0	0	2	756
Luce	0	0	100	95	26	118	0	13	0	381	0	0	0	0	2	735
Mackinac	0	0	50	60	36	106	0	15	0	272	0	0	0	0	2	541
Menominee	3	0	4	41	202	103	0	20	0	205	20	4	0	0	2	604
Schoolcraft	0	0	0	101	56	126	0	20	0	253	0	0	0	0	2	558
Total	3	0	158	580	706	851	0	129	0	1,918	41	18	0	0	15	4,419
W. UPPER PENINSULA:																
Baraga	0	352	7	0	19	269	0	26	0	252	22	71	0	0	2	1,020
Dickinson	3	0	3	0	26	100	0	12	0	36	12	10	0	0	1	203
Gogebic	130	506	22	1	19	281	0	38	0	349	24	8	0	0	3	1,381
Houghton	0	252	79	0	15	276	0	23	0	334	42	32	0	0	2	1,055
Iron	4	266	11	0	36	267	0	28	0	121	25	12	0	0	5	775
Keweenaw	0	0	3	0	7	116	0	9	0	70	8	109	0	0	1	323
Marquette	0	0	10	0	91	384	0	41	0	416	34	542	0	0	3	1,521
Ontonagon	1	11,208	18	1	21	285	0	37	0	380	28	12	0	0	3	11,994
Total	138	12,584	153	2	234	1,978	0	214	0	1,958	195	796	0	0	20	18,272
N. LOWER PENINSULA:																
Emmet	0	0	250	0	0	0	0	0	0	200	0	0	0	0	0	450
Grand Traverse	0	0	0	0	0	0	0	0	0	12	0	12	0	0	0	24
Lake	0	35	0	0	0	0	35	0	0	0	35	35	0	0	0	140
Mason	0	0	0	0	0	0	0	0	0	10	0	15	0	0	0	25
Newaygo	0	35	0	0	0	0	35	0	0	0	35	35	0	0	0	140
Oceana	0	0	138	0	0	0	69	0	0	0	138	69	0	0	0	414
Otsego	0	0	0	0	0	0	0	0	0	15	0	8	0	0	2	25
Total	0	70	388	0	0	0	139	0	0	237	208	174	0	0	2	1,218
S. LOWER PENINSULA																
Allegan	0	0	0	0	0	0	0	0	0	29	0	0	4	23	0	56
Barry	2	0	0	0	0	0	0	0	0	73	11	0	12	47	0	145
Berrien	0	4	12	0	0	0	54	3	3	16	5	23	5	5	26	156
Branch	0	0	0	0	0	0	0	0	0	15	0	31	14	8	0	68
Calhoun	0	0	5	0	0	0	0	0	4	56	12	20	0	6	0	103
Cass	22	0	15	56	0	0	56	0	16	42	28	85	39	6	3	368
Eaton	0	0	0	0	0	0	0	0	0	14	0	0	0	20	0	34
Genessee	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
Hillsdale	0	0	4	0	0	0	0	0	3	23	0	55	0	5	0	90
Ingham	0	0	0	0	0	0	0	0	0	14	0	0	0	4	0	18
Ionia	0	0	0	0	0	0	0	0	0	18	0	0	1	19	0	38
Jackson	0	0	4	0	0	0	0	0	4	25	0	24	4	8	0	69
Kalamazoo	0	0	0	0	0	0	0	0	0	33	7	0	15	7	2	64
Kent	0	0	0	0	0	0	0	0	0	31	0	0	2	20	0	53
Lenawee	0	0	0	0	0	0	0	0	0	9	0	0	0	5	0	14
Livingston	0	0	0	0	0	0	0	0	0	13	0	0	5	6	0	24
Montcalm	0	0	0	0	0	0	0	0	0	25	0	0	4	22	0	51
Muskegon	0	0	0	0	0	0	0	0	0	32	0	0	6	32	0	70
Oakland	0	0	0	0	0	0	0	0	0	0	0	0	1	16	0	17
Ottawa	0	0	0	0	0	0	0	0	0	12	0	0	2	8	0	22
Saginaw	1	0	0	0	0	0	0	0	0	30	0	17	33	5	0	86
St. Joseph	2	0	0	0	0	0	0	0	1	11	0	36	15	8	0	73
Van Buren	28	6	27	56	0	0	191	15	17	17	62	45	19	10	28	521
Washtenaw	0	0	0	0	0	0	0	0	0	17	0	0	0	9	0	26
Total	55	10	67	112	0	0	301	18	48	555	125	336	181	303	59	2,170
State Total	196	12,664	766	694	940	2,829	440	361	48	4,668	569	1,324	181	303	96	26,079

(Table 13 continued on next page)

(Table 13 continued)

MINNESOTA

Unit and county	Ash	Aspen	Bass-wood	White birch	Yellow birch	Cotton-wood	Elm	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
NORTHERN ASPEN-BIRCH:														
Carlton	0	0	0	0	0	0	0	1	3	1	0	0	0	5
Cook	0	8	0	0	0	0	0	0	0	0	0	0	0	8
Koochiching	0	0	0	83	0	0	0	0	0	0	0	0	0	83
Lake	0	420	0	0	0	0	0	0	0	0	0	0	0	420
St. Louis	0	0	1	2	14	0	6	6	8	0	0	0	0	37
Total	0	428	1	85	14	0	6	7	11	1	0	0	0	553
NORTHERN PINE:														
Aitkin	1	10	27	1	1	0	2	14	11	30	0	0	0	97
Beltrami	0	0	0	28	0	0	0	0	0	0	0	0	0	28
Cass	0	0	2	1	1	0	1	5	2	5	0	0	0	17
Itasca	0	0	2	75	4	0	3	10	2	3	0	0	0	99
Total	1	10	31	105	6	0	6	29	15	38	0	0	0	241
CENTRAL HARDWOODS:														
Carver	0	0	0	0	0	0	0	40	0	0	0	0	0	40
Dakota	0	0	0	0	0	0	0	15	0	0	0	0	0	15
Fillmore	6	0	59	0	0	4	6	4	8	126	0	0	0	213
Goodhue	0	0	37	0	0	50	44	1	50	45	2	7	0	236
Houston	7	0	68	0	0	5	21	8	9	187	0	41	6	352
Kanabec	0	5	26	0	0	0	5	0	0	1	0	0	0	37
Le Sueur	0	0	0	0	0	22	19	64	26	0	0	0	0	131
Mille Lacs	0	0	51	0	0	0	0	5	0	26	0	0	0	82
Olmsted	1	0	25	0	0	37	34	1	4	43	0	0	0	145
Rice	0	0	0	0	0	17	15	43	4	0	0	0	0	79
Scott	0	0	0	0	0	0	0	38	15	0	0	0	0	53
Wabasha	1	0	31	0	0	43	36	2	5	98	0	0	0	216
Winona	1	0	47	0	0	76	106	7	7	157	17	59	0	477
Total	16	5	344	0	0	254	286	228	128	683	19	107	6	2,076
PRAIRIE:														
Blue Earth	0	0	0	0	0	0	3	0	0	2	3	14	0	22
Brown	0	0	0	0	0	0	5	0	0	3	5	20	0	33
Dodge	0	0	0	0	0	6	5	0	0	10	0	0	0	21
Faribault	0	0	0	0	0	0	2	0	0	2	2	10	0	16
Freeborn	0	0	0	0	0	0	8	0	0	0	0	0	0	8
McLeod	0	0	36	0	0	43	6	0	0	0	0	0	0	85
Mower	0	0	3	0	0	0	1	0	0	12	0	0	0	16
Nicollet	0	0	0	0	0	12	11	0	8	0	0	0	0	31
Pennington	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Renville	0	0	0	0	0	10	9	0	0	0	0	0	0	19
Sibley	0	0	0	0	0	18	15	10	0	0	0	0	0	43
Steele	0	0	0	0	0	7	6	8	2	0	0	0	0	23
Waseca	0	0	0	0	0	8	7	8	4	0	0	0	0	27
Total	0	0	41	0	0	104	78	26	14	29	10	44	0	346
State Total	17	443	417	190	20	358	376	290	168	751	29	151	6	3,216

(Table 13 continued on next page)

(Table 13 continued)

WISCONSIN

Unit and county	White pine	Ash	Aspen	Bass-wood	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
NORTHEASTERN:																	
Florence	15	14	14	0	0	2	0	0	1,529	0	777	0	41	0	0	0	2,392
Forest	3	2	0	0	0	0	0	0	161	0	221	0	7	0	0	0	394
Langlade	0	26	31	141	0	16	109	0	84	0	390	23	55	0	0	0	875
Lincoln	0	5	0	0	0	6	71	0	27	0	4	0	46	0	0	0	159
Marinette	0	7	0	11	0	10	84	0	37	0	100	129	62	5	0	0	445
Oconto	0	5	0	3	0	6	71	0	27	0	11	48	46	0	0	0	217
Oneida	0	5	653	0	0	6	71	0	27	0	4	0	46	0	0	0	812
Shawano[2]	0	66	39	98	27	15	36	0	293	0	807	103	496	3	0	1	1,984
Vilas	0	0	1,742	0	0	0	0	0	0	0	0	0	0	0	0	0	1,742
Total	18	130	2,479	253	27	61	442	0	2,185	0	2,314	303	799	8	0	1	9,020
NORTHWESTERN:																	
Ashland	0	7	2,068	0	0	16	76	0	49	0	50	0	8	0	0	0	2,274
Barron	0	11	59	0	0	6	1	0	36	0	58	0	164	0	0	0	335
Bayfield	0	7	1,096	0	0	14	76	0	74	0	50	0	8	0	0	0	1,325
Burnett	0	0	8	0	0	0	0	0	10	0	0	0	6	0	0	0	24
Douglas	0	0	555	0	0	0	0	0	22	0	0	0	0	0	0	0	577
Iron	0	7	3,375	0	0	11	76	0	49	0	23	0	8	0	0	0	3,549
Polk	0	11	6	0	0	6	1	0	155	0	4	0	487	0	0	0	670
Price	0	0	7	10	0	0	0	0	36	0	0	0	0	0	0	0	53
Rusk	0	0	109	0	0	0	0	0	0	0	0	0	20	0	0	0	129
Sawyer	0	0	871	0	0	0	0	0	28	0	32	0	29	0	0	0	960
Taylor	0	0	6	0	0	0	0	0	21	0	0	0	0	0	0	0	27
Washburn	0	0	446	0	0	0	0	0	15	0	0	0	92	0	0	0	553
Total	0	43	8,606	10	0	53	230	0	495	0	217	0	822	0	0	0	10,476
CENTRAL																	
Adams	0	9	0	0	0	5	8	0	43	0	4	0	33	0	0	0	102
Chippewa	0	11	0	0	0	6	1	0	27	0	3	0	242	0	0	0	290
Clark	0	9	0	0	0	5	8	0	43	0	4	0	33	0	0	0	102
Eau Claire	0	11	0	0	0	6	1	0	27	0	3	0	147	0	0	0	195
Juneau	0	0	0	0	0	0	0	0	0	0	3	0	114	0	0	0	117
Marathon	0	24	0	61	0	11	43	0	88	0	125	28	117	3	0	0	500
Monroe	0	0	0	13	0	3	0	0	0	0	26	30	97	0	0	0	169
Portage	0	9	0	1	0	5	8	0	43	0	4	0	94	2	0	0	166
Waupaca	0	14	0	14	0	7	11	0	48	0	25	7	62	1	0	0	189
Wood	0	10	0	2	0	5	8	0	49	0	4	2	41	4	0	0	125
Total	0	97	0	91	0	53	88	0	368	0	201	67	980	10	0	0	1,955

(Table 13 continued on next page)

(Table 13 continued)

WISCONSIN (continued)

Unit and county	White pine	Ash	Aspen	Bass-wood	Beech	White birch	Yellow birch	Cotton-wood	Elm	Hickory	Hard maple	Soft maple	Red oak	White oak	Walnut	Other hard-woods	All species
SOUTHWESTERN:																	
Buffalo	0	11	0	31	0	9	1	0	27	0	46	8	170	0	0	1	304
Crawford	0	8	0	44	0	8	0	0	12	0	44	23	326	0	17	2	484
Dunn	0	11	0	8	0	6	46	0	27	0	3	0	157	0	0	0	258
Grant	0	10	0	23	0	9	0	0	12	0	42	5	204	0	18	2	325
Iowa	0	7	0	17	0	7	0	0	12	0	33	4	354	77	13	2	526
LaCrosse	0	14	0	28	0	9	1	9	28	0	26	86	508	9	5	1	724
Lafayette	0	6	0	5	0	6	0	0	12	0	18	1	189	0	4	2	243
Pepin	0	11	0	0	0	6	1	18	27	0	3	0	147	0	0	1	214
Pierce	0	11	0	0	0	6	1	0	27	0	4	0	147	0	0	0	196
Richland	0	29	0	79	0	7	0	0	40	0	156	19	443	0	13	2	788
St. Croix	0	11	0	0	0	6	8	0	27	0	4	0	147	0	0	0	203
Sauk	0	59	26	258	0	5	0	0	12	26	153	130	2,346	258	19	2	3,294
Trempealeau	0	10	20	20	0	9	1	42	38	0	28	4	165	0	0	1	338
Vernon	0	7	0	54	0	8	1	0	12	0	84	10	565	0	19	2	762
Total	0	205	46	567	0	101	60	69	313	26	644	290	5,868	344	108	18	8,659
SOUTHEASTERN:																	
Brown	0	0	0	0	0	0	0	0	0	0	9	0	28	0	0	0	37
Calumet	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	28
Columbia	0	6	0	0	0	4	0	0	12	0	12	0	320	58	0	2	414
Dane	0	0	0	0	0	0	0	0	0	0	0	0	143	39	10	0	192
Dodge	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0	27
Door	0	0	0	0	0	0	0	21	0	0	9	0	0	0	0	0	30
Green	0	0	0	0	0	0	0	0	0	0	0	0	28	6	41	0	75
Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	17
Kenosha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6
Kewaunee	0	0	5	0	0	0	0	0	52	0	9	0	28	0	0	0	94
Manitowoc	0	0	0	0	0	0	0	0	0	0	9	0	28	0	0	0	37
Outagamie	0	1	0	0	0	0	0	0	34	0	1	23	0	0	0	0	59
Racine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8
Rock	0	0	0	0	0	0	0	0	6	4	0	0	4	2	22	5	43
Sheboygan	0	0	0	0	0	0	0	27	260	0	9	52	80	0	0	0	428
Walworth	0	0	0	0	0	0	0	0	0	0	0	0	11	4	14	0	29
Washington	0	0	0	0	0	0	0	0	0	0	10	0	28	0	0	0	38
Waukesha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20
Total	0	7	5	0	0	4	0	48	364	4	68	75	753	109	138	7	1,582
State total	18	482	11,136	921	27	272	820	117	3,725	30	3,444	735	9,222	471	246	26	31,695

[1]International ¼-inch rule.
[2]Includes Menominee County.

Table 14.—*Residue produced at Lake States primary wood-using mills by type of material and use, 1975*
(In thousand tons, green weight)

State and type of use	Wood residue							
	Total		Coarse[1]		Fine[2]		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
TOTAL MICHIGAN:								
Fiber products	40.78	264.24	40.75	259.13	.03	5.11	.98	4.93
Charcoal	.20	.09	.20	.09	0.00	0.00	.05	0.00
Industrial fuel	11.27	58.79	3.03	13.88	8.24	44.91	7.22	38.56
Domestic fuel	4.73	62.28	4.35	53.12	.38	9.16	1.37	18.83
Miscellaneous[3]	7.18	98.97	.58	27.30	6.60	71.67	1.10	32.32
Not used	34.63	160.52	14.08	40.61	20.55	119.91	21.10	78.26
Total	98.79	644.89	62.99	394.13	35.80	250.76	31.82	172.90
TOTAL MINNESOTA:								
Fiber products	31.47	82.85	28.35	78.08	3.12	4.77	0.00	1.33
Charcoal	1.61	6.03	1.61	6.03	0.00	0.00	.66	1.84
Industry fuel	36.06	4.50	22.35	.79	13.71	3.71	12.74	7.44
Domestic fuel	10.28	28.89	9.90	23.75	.38	5.14	3.05	7.80
Miscellaneous[3]	4.67	16.73	2.50	1.42	2.17	15.31	.26	8.44
Not used	39.82	60.10	13.77	14.19	26.05	45.91	20.34	38.53
Total	123.91	199.10	78.48	124.26	45.43	74.84	37.05	65.38
TOTAL WISCONSIN:								
Fiber products	63.68	341.40	59.56	300.19	4.12	41.21	.04	2.89
Charcoal	.08	8.30	.08	8.30	0.00	0.00	.03	2.69
Industrial fuel	35.63	110.27	5.03	32.66	30.60	77.61	24.58	72.02
Domestic fuel	11.60	47.28	11.00	47.19	.60	.09	4.15	15.13
Miscellaneous[3]	10.12	118.86	.26	4.44	9.86	114.42	3.76	43.52
Not used	13.10	52.58	8.88	18.28	4.22	34.30	4.92	50.47
Total	134.21	678.69	84.81	411.06	49.40	267.63	37.48	186.72

[1]Suitable for chipping such as slabs, edgings, veneer cores, etc.
[2]Not suitable for chipping such as sawdust, veneer clippings, etc.
[3]Livestock bedding, mulch, small dimension, and specialty items.

U.S.GPO:1980-669-260/59-6

Blyth, James E., James W. Whipple, Allen H. Boelter, and Steven Wilhelm.
1980. Lake States primary forest industry and timber use, 1975. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-49, 39 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses industrial roundwood production and forest industry trends in Michigan, Minnesota, and Wisconsin. Compares log and bolt production by State for several products and species and discusses primary wood-using mill residue and its use.

KEY WORDS: pulpwood, saw logs, production, wood residue, bark, particleboard.

Blyth, James E., James W. Whipple, Allen H. Boelter, and Steven Wilhelm.
1980. Lake States primary forest industry and timber use, 1975. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-49, 39 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses industrial roundwood production and forest industry trends in Michigan, Minnesota, and Wisconsin. Compares log and bolt production by State for several products and species and discusses primary wood-using mill residue and its use.

KEY WORDS: pulpwood, saw logs, production, wood residue, bark, particleboard.

Man paints houses...

only nature should paint

trees and rocks.

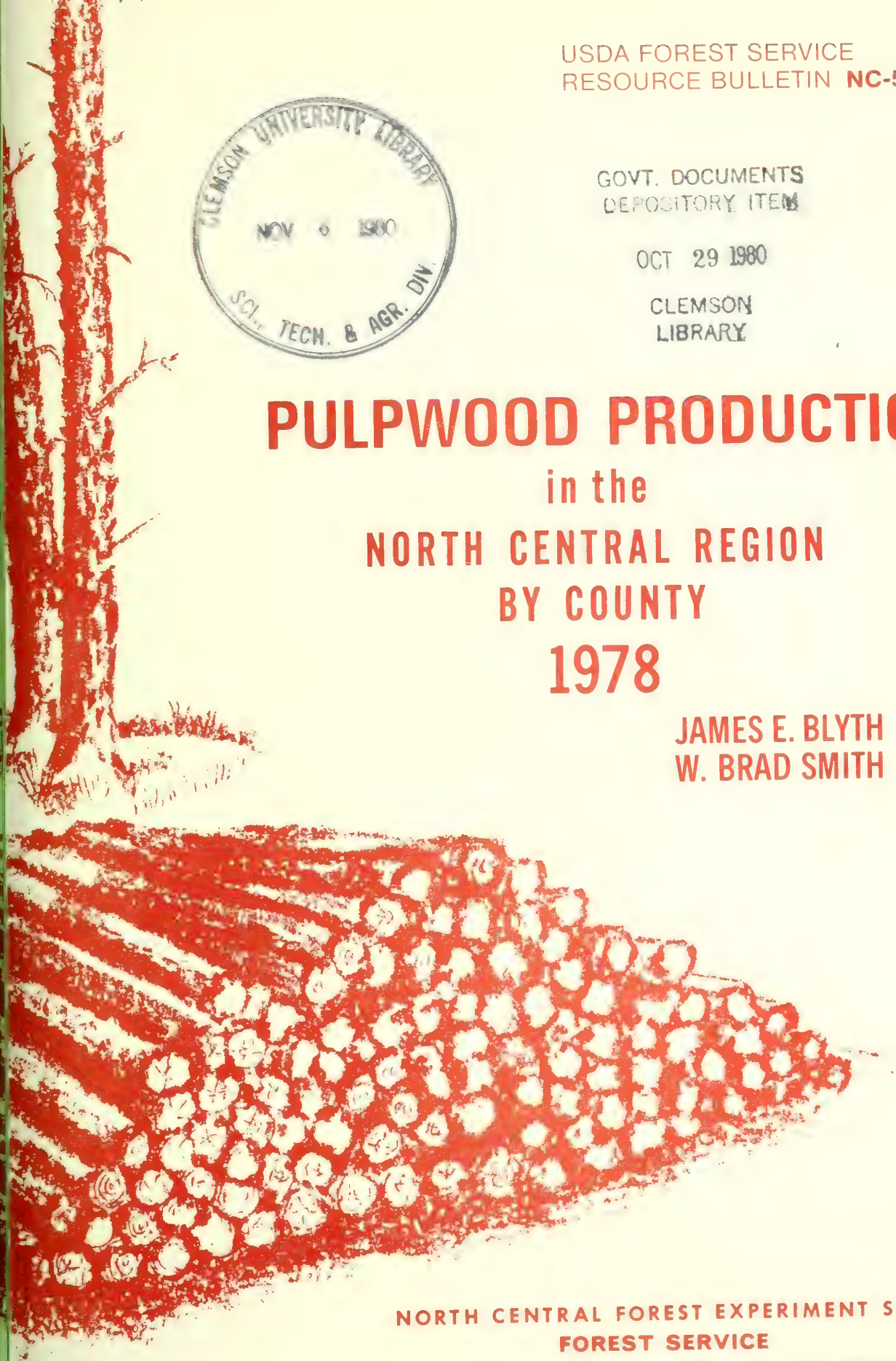
USDA FOREST SERVICE
RESOURCE BULLETIN **NC-50**

CLEMSON UNIVERSITY LIBRARY
NOV 6 1980
SCI., TECH. & AGR. DIV.

GOVT. DOCUMENTS
DEPOSITORY ITEM
OCT 29 1980
CLEMSON
LIBRARY

PULPWOOD PRODUCTION
in the
NORTH CENTRAL REGION
BY COUNTY
1978

JAMES E. BLYTH
W. BRAD SMITH



NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

HIGHLIGHTS

Lake States

Lake States pulpwood production advanced 3 percent in 1978 to 4.91 million cords. Pulpwood demand was stimulated by the record national demand for paper and paperboard.

Major production gains were in hard maple, red pine, jack pine, and aspen. Elm production continued to fall from the peak set in 1976. Loggers cut 237,000 cords of whole tree chips, up 64 percent from 1977. Minnesota was the major producer, but Michigan production also expanded strongly.

Demand for Michigan and Wisconsin birch reached new highs, while demand for Minnesota birch plunged to the lowest point since 1969. Procurement of Wisconsin pine and hardwood residue climbed to high points.

Softwood residue receipts surpassed the 1977 record as Canada increased softwood residue shipments to the Lake States for the sixth consecutive year.

Pulpmills will soon be competing for aspen with waferboard plants since they use similar kinds of boltwood. Demand for Lake States aspen in waferboard manufacturing may increase by 600,000 to 800,000 cords by 1982 or 1983.

Central States

Demand for Central States pulpwood dropped slightly to 430,000 cords; hard hardwood production was the lowest since 1959. Half of the total production was exported; three-fourths of the exports was hardwood residue. Indiana, the leading producer, had a record output. Pulpwood receipts rose nominally; 15 percent was imported from 14 widely scattered States.

North Central Forest Experiment Station
Forest Service - U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Manuscript approved for publication November 30, 1979
1980

PULPWOOD PRODUCTION IN THE NORTH CENTRAL REGION BY COUNTY, 1978

James E. Blyth, *Principal Market Analyst,*
and **W. Brad Smith,** *Associate Mensurationist*

This is the 20th annual report of the pulpwood harvest in Lake States counties and the 19th annual report of the Central States harvest. Pulpwood constitutes more than half the timber products harvested annually in the Lake States (Michigan, Minnesota, and Wisconsin) and is an important product in the Central States (Illinois, Indiana, Iowa, and Missouri).

Current detailed pulpwood production[1] information is necessary for intelligent planning and decision-making in wood procurement, forest resource management, and forest industry development. Also, researchers need current pulpwood information for planning projects.

Pulpmills using North Central States timber in 1978 reported their pulpwood receipts[2] by species groups and counties of origin. This report presents the results of the survey, analyzes the data where appropriate, compares results with 1977 or earlier years, and discusses trends in pulpwood production and use.

The Lake States and Central States are discussed separately because the timber types in each area are different and less information can be released about the Central States (more detailed data on pulpwood production and receipts in the Central States would reveal the operations of individual mills).

Pulpwood production in Minnesota is completely and accurately shown. However, to prevent disclosure of confidential information about softwood pulpwood use by individual companies, the total quantity of softwood pulpwood imports and exports between Minnesota and Canada are not reported. Thus, some Minnesota softwood shipped to Canada is shown as remaining and used in Minnesota, and receipts of Canadian softwood in Minnesota are understated.

LAKE STATES

Production

Lake States pulpwood production climbed 3 percent in 1978 to 4.91 million cords (table 1). Demand for pulpwood rose because national demand for paper was at a record level. Paper and paperboard production in the United States was 63.7 million tons in 1978 compared to 62.0 million tons in 1977. Pulpwood consumption in the United States was higher in 1978 than in any year since 1974.

Nine out of 10 cords produced were roundwood (including chips from roundwood); the remainder was residue from local wood-using plants[3]. All of the production increase in 1978 came from roundwood as pulpwood production from residue fell 21,000 cords. Only 1 percent of total production was shipped outside the Lake States.

---

[1]*Pulpwood production, determined from mill receipts, is the annual volume of pulpwood cut in a specific county or region, plus the annual wood residue volume produced by sawmills, veneer mills, etc., in a specific State or region that was used for pulp manufacturing.*

[2]*Pulpwood receipts are the volume of wood received by mills in a specific State or region, regardless of the geographic source.*

[3]*Residue is the byproduct from sawmills, veneer mills, cooperage mills, and other wood-using plants that is used for pulping. Residue includes slabs, edgings, veneer cores, sawdust, wood flour, and chips manufactured from slabs, edgings, and veneer cores.*

Table 1.—*Production and imports of pulpwood, Lake States, 1978*

(In standard cords, unpeeled)

SPECIES AND DISPOSITION	PRODUCTION BY STATES 1/				IMPORTS			TOTAL RECEIPTS
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U.S. 2/	CANADA	TOTAL IMPORTS	
CEDAR								
MICHIGAN	[illegible]	0	1159	7271	0	0	0	7271
TOTAL	[illegible]	0	1159	7271	0	0	0	7271
BALSAM FIR								
MICHIGAN	46845	0	7494	54339	0	0	0	54339
MINNESOTA	0	89967	0	89967	0	0	0	89967
WISCONSIN	2294	891	65360	98546	0	889	889	99435
EXPORTED 2/	8202	4929	2287	15428	0	0	0	0
TOTAL	87342	95787	75141	258280	0	889	889	243741
HEMLOCK								
MICHIGAN	42927	0	7986	50913	0	0	0	50913
WISCONSIN	5496	0	44232	49718	0	0	0	49718
TOTAL	48411	0	52210	100631	0	0	0	100631
JACK PINE								
MICHIGAN	130188	0	5340	136528	0	0	0	136528
MINNESOTA	0	134887	0	134887	0	1976	1976	136863
WISCONSIN	60246	25208	212684	298158	44646 4/	0	44646 4/	342804
EXPORTED 3/	953	5019	0	6472	0	0	0	0
TOTAL	192007	165014	218024	576045	44646	1976	46622	616195
RED PINE								
MICHIGAN	67462	0	3915	71377	0	0	0	71377
MINNESOTA	0	9836	0	9836	0	0	0	9836
WISCONSIN	6575	5097	117471	129143	0	0	0	129143
TOTAL	74037	14933	121386	210356	0	0	0	210356
WHITE PINE								
MICHIGAN	8474	0	1674	10148	0	0	0	10148
MINNESOTA	0	4636	0	4636	0	0	0	4636
WISCONSIN	2362	124	16353	18839	0	0	0	18839
TOTAL	10836	4760	18027	33623	0	0	0	33623
SPRUCE								
MICHIGAN	17676	0	2007	19683	0	0	0	19683
MINNESOTA	0	132154	1758	133912	0	2076	2076	135988
WISCONSIN	15380	27529	15673	58582	0	23792	23792	82374
EXPORTED 3/	9439	4222	127	13788	0	0	0	0
TOTAL	42495	163905	19565	225965	0	25868	25868	238045
TAMARACK								
MICHIGAN	888	0	33	921	0	0	0	921
MINNESOTA	0	9759	0	9759	0	0	0	9759
WISCONSIN	862	20897	2986	24745	0	291	291	25036
TOTAL	1750	30656	3019	35425	0	291	291	35716
ASH								
MICHIGAN	7046	0	4	7050	0	0	0	7050
MINNESOTA	0	729	0	729	0	0	0	729
WISCONSIN	4026	1750	21317	27093	0	0	0	27093
EXPORTED 3/	0	0	41	41	0	0	0	0
TOTAL	11072	2479	21362	34913	0	0	0	34872
ASPEN								
MICHIGAN	421757	0	827	422584	0	0	0	422584
MINNESOTA	0	634965	12029	646994	0	0	0	646994
WISCONSIN	163851	69412	654495	887758	0	0	0	887758
EXPORTED 2/	0	0	1343	1343	0	0	0	0
TOTAL	[illegible]	[illegible]	[illegible]	1958679	0	0	0	1957336

(TABLE 1 CONTINUED ON NEXT PAGE)

(TABLE 1 CONTINUED)

SPECIES AND DESTINATION	PRODUCTION BY STATE 1/ MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U. S.	CANADA	OVERSEAS	TOTAL
BALSAM POPLAR								
MICHIGAN	25297	0	132	25429	0	0	0	25429
MINNESOTA	0	13000	0	13000	0	0	0	13000
TOTAL	25297	13000	132	42429	0	0	0	42429
BASSWOOD								
MICHIGAN	4429	0	0	4429	0	0	0	4429
MINNESOTA	0	71	0	71	0	0	0	71
WISCONSIN	347	0	11384	11731	0	0	0	11731
EXPORTED 3/	0	0	506	506	0	0	0	506
TOTAL	4776	71	11784	16141	0	0	0	16541
BEECH								
MICHIGAN	9383	0	101	9484	0	0	0	9484
WISCONSIN	1104	0	2	1106	0	0	0	1106
TOTAL	10587	0	103	10690	0	0	0	10690
WHITE BIRCH								
MICHIGAN	61897	0	735	62632	0	0	0	62632
MINNESOTA	0	2698	0	2698	0	0	0	2698
WISCONSIN	5427	6494	97113	109034	0	0	0	109034
EXPORTED 3/	0	0	220	220	0	0	0	0
TOTAL	67324	9192	98118	174634	0	0	0	174414
YELLOW BIRCH								
MICHIGAN	8655	0	97	8752	0	0	0	8752
WISCONSIN	13740	36	22655	36431	0	0	0	36431
TOTAL	22395	36	22752	45183	0	0	0	45183
COTTONWOOD								
EXPORTED 3/	0	0	91	91	0	0	0	0
TOTAL	0	0	91	91	0	0	0	0
ELM								
MICHIGAN	7212	0	252	7464	0	0	0	7464
MINNESOTA	0	2926	0	2926	0	0	0	2926
WISCONSIN	18763	2307	109663	130733	0	0	0	130733
EXPORTED 3/	0	2267	47	2314	0	0	0	0
TOTAL	25975	7500	109962	143407	0	0	0	141113
HICKORY								
MICHIGAN	0	0	14	14	0	0	0	14
WISCONSIN	0	0	611	611	0	0	0	611
TOTAL	0	0	625	625	0	0	0	625
HARD MAPLE								
MICHIGAN	44759	0	695	45454	0	0	0	45454
WISCONSIN	37444	678	90247	128369	0	0	0	128369
TOTAL	82203	678	90942	173823	0	0	0	173823
SOFT MAPLE								
MICHIGAN	104407	0	799	105206	0	0	0	105206
MINNESOTA	0	2477	0	2477	0	0	0	2477
WISCONSIN	15728	521	70026	86275	0	0	0	86275
EXPORTED 3/	0	0	673	673	0	0	0	0
TOTAL	120135	2998	71498	194631	0	0	0	193958
RED OAK								
MICHIGAN	85017	0	18	85035	0	0	0	85035
MINNESOTA	0	7536	0	7536	0	0	0	7536
WISCONSIN	224	748	47254	48226	0	0	0	48226
EXPORTED 3/	0	0	4420	4420	0	0	0	0
TOTAL	85241	8284	51692	145217	0	0	0	140797

(TABLE 1 CONTINUED ON NEXT PAGE)

(TABLE 1 CONTINUED)

[illegible]	PRODUCTION BY STATES 1/				IMPORTS			TOTAL
	MICHIGAN	MINNESOTA	WISCONSIN	REGIONAL TOTAL	OTHER U. S. 2/	CANADA	TOTAL IMPORTS	RECEIPTS
[illegible]								
MICHIGAN	18414	0	0	18416	0	0	0	18416
WISCONSIN	357	0	7188	7545	0	0	0	7545
EXPORTED 3/	0	0	1624	1624	0	0	0	0
TOTAL	18773	0	8812	27585	0	0	0	25961
OTHER HARDWOODS								
MICHIGAN	3450	0	32	3482	0	0	0	3482
WISCONSIN	2584	0	3692	6276	0	0	0	6276
TOTAL	6034	0	3724	9758	0	0	0	9758
TOTAL ROUNDWOOD								
MICHIGAN	1122807	0	33401	1156208	0	0	0	1156208
MINNESOTA	0	1049451	13787	1063238	0	4052	4052	1067290
WISCONSIN	386911	161687	1612206	2160804	44646	24972	69618	2230422
EXPORTED 3/	18194	17347	11366	46907	0	0	0	0
TOTAL	1527912	1228485	1670760	4427157	44646	29024	73670	4453920
RESIDUE, SOFTWOOD								
MICHIGAN	16405	0	892	17297	0	4121	4121	21418
MINNESOTA	0	32337	0	32337	18516	9112	27628	59965
WISCONSIN	239	328	39203	39770	197735	63494	261229	300999
EXPORTED 3/	533	2617	322	3472	0	0	0	0
TOTAL	17177	35282	40417	92876	216251	76727	292978	382382
RESIDUE, HARDWOODS								
MICHIGAN	108280	0	35881	144161	10219	0	10219	154380
MINNESOTA	0	72911	12111	85022	1878	3413	5291	90313
WISCONSIN	17136	338	127371	144845	0	0	0	144845
EXPORTED 3/	4467	1148	8101	13716	0	0	0	0
TOTAL	129883	74397	183464	387744	12097	3413	15510	389538
ALL WOOD MATERIAL								
MICHIGAN	1247492	0	70174	1317666	10219	4121	14340	1332006
MINNESOTA	0	1154699	25898	1180597	20394	16577	36971	1217568
WISCONSIN	404286	162353	1778780	2345419	242381	88466	330847	2676266
EXPORTED 3/	23194	21112	19789	64095	0	0	0	0
TOTAL	1674972	1338164	1894641	4907777	272994	109164	382158	5225840

1/ VERTICAL COLUMNS OF FIGURES UNDER BOX HEADING -PRODUCTION BY STATES- PRESENT THE AMOUNT OF PULPWOOD CUT IN EACH STATE.
2/ MOSTLY WESTERN STATES.
3/ PULPWOOD SHIPPED TO MILLS OUTSIDE OF REGION.
4/ PONDEROSA PINE.

Lake States loggers harvested 185,000 cords more in 1978 than in 1977; gains were primarily in hard maple (55,000 cords), red pine (43,000 cords), jack pine (41,000 cords) and aspen (34,000 cords). Elm production fell another 34,000 cords as it continued to decline from the peak level of 1976. Pine pulpwood harvesting was 31,000 cords higher than the previous peak in 1974.

Pulpwood production from whole-tree chips[4] rose to 237,000 cords, up 92,000 cords from 1977. One out of every 20 cords produced was whole-tree chips. Production of whole-tree chips by species group and State was:

State	Softwoods	Aspen	Other hardwoods
	Thousand cords		
Michigan	1.0	62.8	28.5
Minnesota	—	133.8	7.1
Wisconsin	—	3.6	—

Each State gained in production; Wisconsin produced no whole-tree chips in 1977.

[4]*Pulpwood produced from chipping entire trees (all portions of trees above ground, except the stumps).*

Michigan.—Producers increased their output to 1.67 million cords, higher than in any year except 1974. Birch production was the highest recorded—90,000 cords. Other major gains were in aspen and soft maple. Demand for Michigan hardwood residue at pulpmills fell sharply. Increased harvesting was concentrated in the western Upper Peninsula and northern Lower Peninsula. Counties supplying more than 100,000 cords were Iron, Marquette, and Dickinson.

Minnesota.—Minnesota furnished 1.34 million cords of pulpwood as production remained within a narrow range of ± 50,000 cords since 1975. Demand for birch fell to the lowest level since 1969. Other changes within species were nominal. Pulpwood harvesting dropped for the fourth consecutive year in the Aspen-Birch Unit as it increased in 1978 in each of the other Units. Logging greatly intensified in Aitkin and Mille Lacs Counties, apparently in response to firms shifting their procurement areas. St. Louis, Koochiching, and Itasca Counties provided 57 percent of the roundwood to pulp mills.

Wisconsin.—Demand for Wisconsin pulpwood rose to 1.89 million cords, second only to 1974. Pine and birch roundwood and hardwood residue demand reached new highs. Hard maple output rebounded strongly from a low point in 1977. Procurement of elm was moderately lower. Logging increased 70,000 cords in the Northwestern Unit while declining slightly in the Northeastern and Central Units. Top-producing counties were Oneida, Price, Marinette, and Forest.

The distribution of the harvest is shown here in two ways: first, the amount of pulpwood cut relative to the growing stock volume in major pulpwood species (fig. 1); and second, the amount of pulpwood cut relative to commercial forest area (fig. 2). Cutting pressure increased more in Michigan's Western Upper Peninsula than elsewhere.

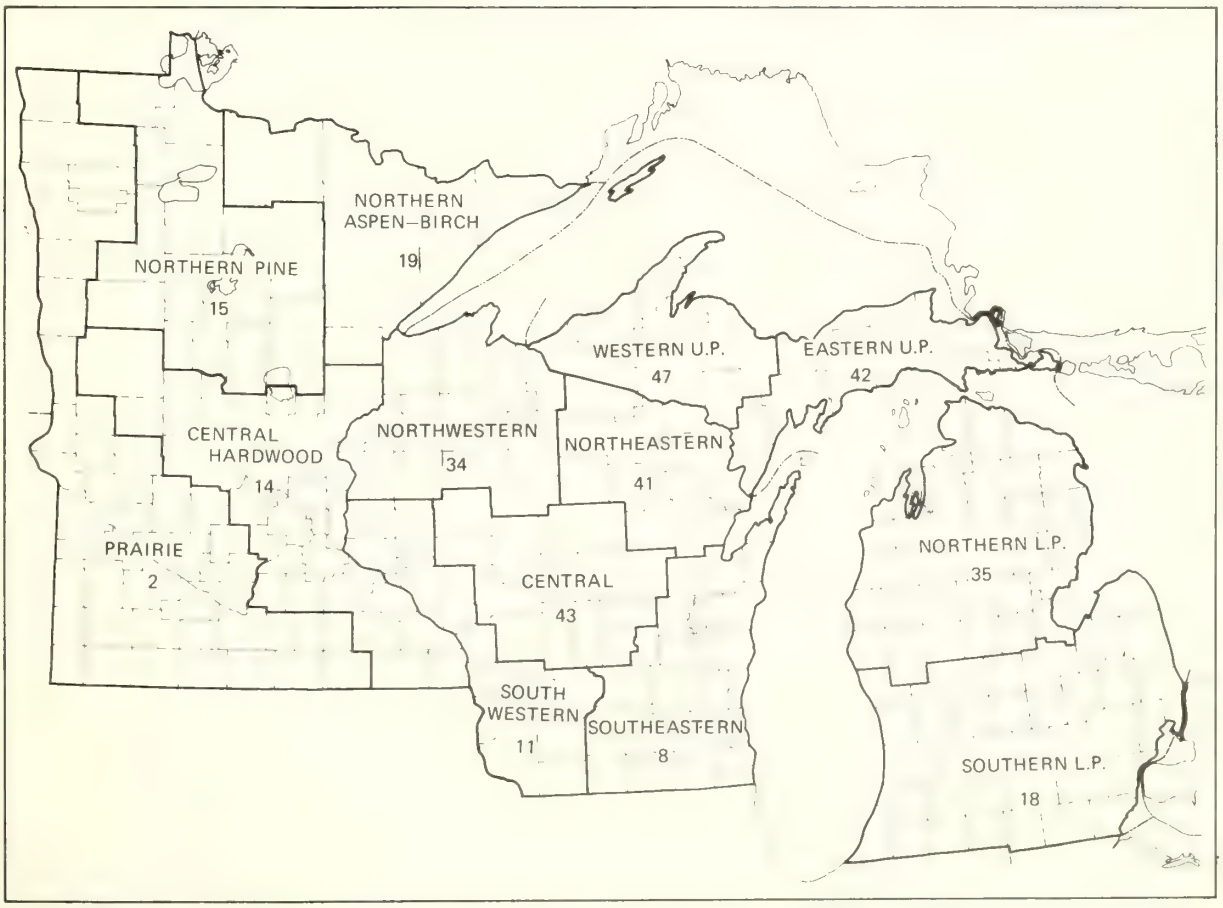


Figure 1.—*Cords of pulpwood bolts and logs harvested per 1,000 cords of merchantable volume in principal pulpwood species by Forest Survey Unit, 1978. Merchantable volume was determined during the last forest inventory in each State. New Minnesota merchantable volume data were used for the first time in preparing this figure.*

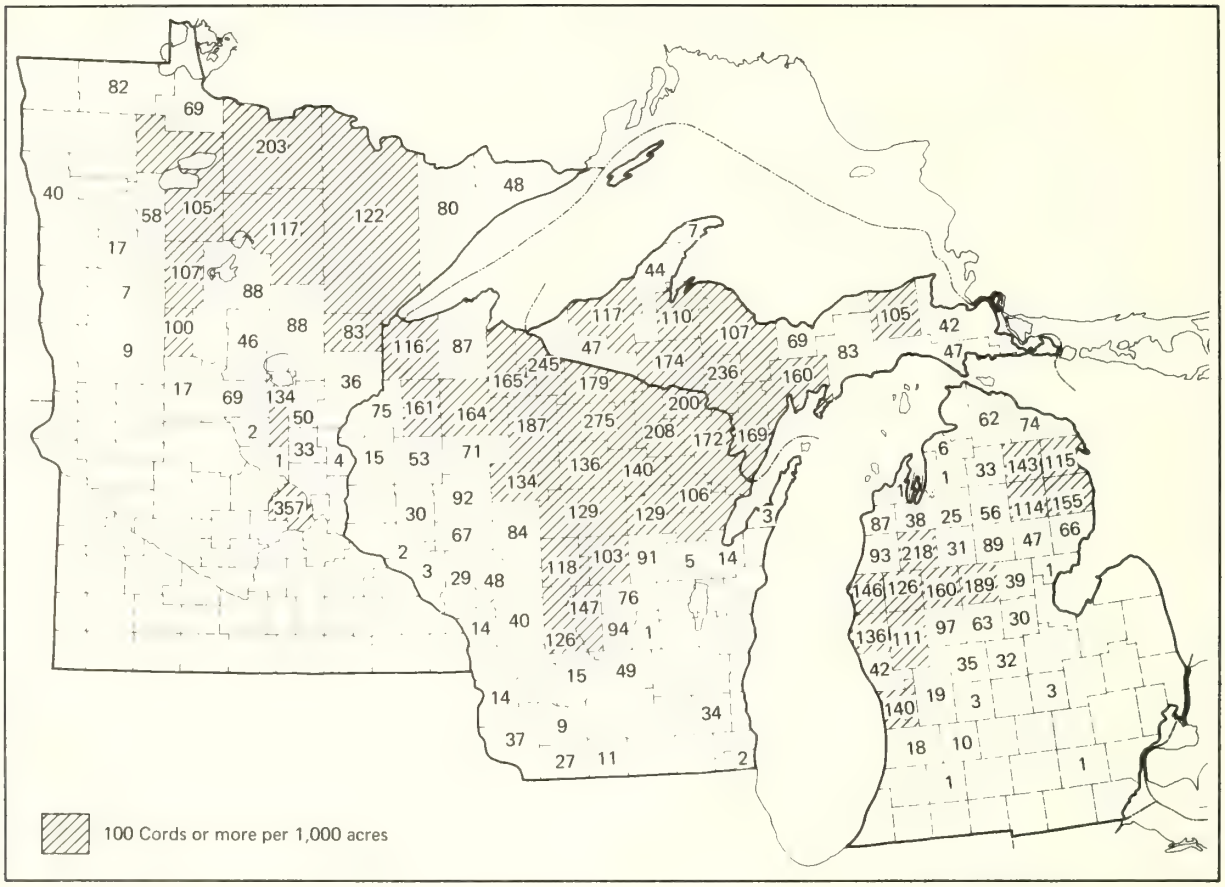


Figure 2.—*Cords of pulpwood cut per 1,000 acres of stocked commercial forest land in principal pulpwood-producing counties, 1978. Acres of stocked commercial forest land were determined during the last forest inventory in each State. New Minnesota forest land data were used for the first time in preparing this figure.*

Receipts

Forty-one Lake States pulpmills procured 5.23 million cords of pulpwood in 1978. Aspen was widely used in 19 of 24 Wisconsin mills and all Michigan and Minnesota mills (table 2). Annual softwood residue receipts, quadrupling since the mid-1960's, surpassed the 1977 all-time high by 9,000 cords. No hardwood roundwood was imported, the first negative report since 1964.

Canada increased softwood residue shipments to the Lake States for the sixth consecutive year; Wisconsin was the principal market. Prior to 1969, Lake States mills purchased no softwood residue from Canada.

Other States shipped 273,000 cords to the Lake States, up 7 percent from 1977. South Dakota, Wyoming, Montana, and Colorado furnished 79 percent of these imports as softwood residue chips.

Michigan.—Pulpwood receipts improved by 99,000 cords to inch ahead of the 1974 record. Pine demand reached a new peak; 63 percent was jack pine, 33 percent was red pine, and the remainder was white pine.

Wisconsin.—Overall receipts climbed 80,000 cords, even though spruce procurement plunged to a fifth consecutive yearly low. Birch and softwood residue deliveries hit new highs. Pine roundwood demand advanced sharply. Out-of-State sources supplied one-third of Wisconsin's total pulpwood requirements.

Table 2.—*Numbers of industrial plants in the Lake States using a particular species or residue for pulping in 1978*

Species and kind of material	Total Lake States	Michigan	Minnesota	Wisconsin
Aspen	36	8	9	19
Balsam fir	16	3	5	8
Birch	19	5	2	12
Hemlock	8	1	—	7
Pine	9	3	2	4
Spruce	14	2	5	7
Tamarack	7	1	2	4
Maple	15	6	—	9
Oak	13	5	1	7
Other hardwoods	17	6	2	9
Softwood residue	13	2	3	8
Hardwood residue	16	6	3	7
Total plants[1]	41	8	9	24

[1]Some plants use more than one species, so numbers in columns cannot be added.

Industry Trends and Analysis

Average daily production in the Lake States rose 390 tons from 1977 to 11,200 tons (table 3). One small mill ceased pulping operations during 1978 but is continuing to manufacture paper.

Pulpmills in the Lake States will soon be competing for aspen with waferboard plants since they use similar kinds of boltwood. Four new waferboard plants have been announced for Minnesota and another opened in Wisconsin in 1979. A large expansion is planned at another Minnesota waferboard plant. Several firms are looking for other waferboard opportunities in the Lake States.

These new plants will have a direct impact on the forest resource. Unlike many particleboard plants in the West and South, Lake States waferboard plants will use roundwood rather than mill residue.

Aspen is the preferred species for waferboard but others are likely to supplement aspen. Demand for Lake States aspen in waferboard manufacturing may increase by 600,000 to 800,000 cords annually by 1982 or 1983—30 to 40 percent of the current aspen used for pulpwood. As aspen demand grows, procurement patterns will change. Delivered prices for aspen will rise in some areas (particularly in Minnesota), and average aspen haul distance to mills is likely to increase. Aspen harvesting will probably expand significantly in "fringe" counties, that is, those counties bordering the current major aspen procurement areas.

Mills capable of substituting other species for aspen should have wood cost advantages and fewer wood supply problems compared to those that cannot substitute.

Pulpmills requiring additional supplies of softwoods can obtain some from aspen stands harvested primarily for waferboard bolts because 10 to 20 percent of the volume in the aspen type is softwood.

Minnesota contains large areas of overmature aspen subject to pestilence and disease. If these stands are properly harvested, they can be regenerated to aspen or converted to other species to improve production. Opportunities for aspen forest management by harvesting overmature stands appear excellent.

CENTRAL STATES

Production

Pulpwood production dropped slightly in 1978 to 430,000 cords (table 4). Hard hardwood production was the lowest since 1959. However, after three straight years of record low harvests (since 1955) of soft hardwoods, Central States loggers reversed the trend by raising the soft hardwood output by 14,000 cords. Pulpwood markets were relatively stable for wood residue generated at Central States wood-using firms.

Exports from the Central States were firm although off from the record level of 1977. Half of the total production was exported to Michigan, Minnesota, Ohio, and Kentucky. More than three-fourths of the wood exports was hardwood residue, chiefly from sawmills in Indiana, Missouri, and Illinois.

Indiana, the leading producer, had a record output of 190,000 cords; the previous peak was 172,000 cords in 1976. Most of the increase was hardwood residue. Indiana production has been in an upward trend from a plateau established in the 1961-1965 period. Output fell in each of the other Central States.

Loggers cut pulpwood in 79 counties: 26 in Illinois, 20 in Indiana, 20 in Missouri, and 13 in Iowa (fig. 3).

Table 3.—*Active wood pulp mills in the Lake States, by location, type of pulp produced, and average daily production, 1978*[1]

(In tons per 24 hours)

COMPANY	LOCATION	AVERAGE PRODUCTION IN TONS PER 24 HOURS 1/				
		TOTAL	SULFITE	KRAFT	GROUNDWOOD AND OTHER MECHANICAL	SEMI-CHEMICAL
MICHIGAN:						
ABITIBI CORP.	ALPENA	430	0	0	430	0
CELOTEX CORP.	L ANSE	270	0	0	270	0
CHAMPION INTERNATIONAL	ONTONAGON	440	0	0	0	440
MANISTIQUE PULP AND PAPER CO.	MANISTIQUE	90	0	0	90	0
MEAD CORP.	ESCANABA	750	0	600	150	0
MENASHA CORP.	OTSEGO	225	0	0	0	225
PACKAGING CORP.OF AMERICA	FILER CITY	600	0	0	0	600
WARREN CO., S.D.	MUSKEGON	250	0	250	0	0
TOTAL.....	8 PLANTS.....	3055	0	850	940	1265
MINNESOTA :						
BLANDIN PAPER CO.	GRAND RAPIDS	325	0	0	325	0
HENNEPIN PAPER CO.	LITTLE FALLS	75	0	0	75	0
BOISE CASCADE CORP.	INTERNATIONAL FALLS	880	0	340	540	0
POTLATCH CORP.	CLOQUET	440	0	440	0	0
SUPERWOOD CORP.	BEMIDJI	90	0	0	90	0
ST REGIS PAPER CO.	SARTELL	135	0	0	135	0
SUPERWOOD CORP.	DULUTH	350	0	0	350	0
CHAMPION INTERNATIONAL	ST PAUL	300	0	0	0	300
CONWED CORP.	CLOQUET	350	0	0	350	0
TOTAL.....	9 PLANTS.....	2945	0	780	1865	300
WISCONSIN :						
AMERICAN CAN CO.	GREEN BAY	210	150	0	60	0
WEYERHAEUSER CO.	ROTHSCHILD	200	200	0	0	0
BADGER PAPER MILLS	PESHTIGO	110	110	0	0	0
APPLETON PAPERS INC.	COMBINED LOCKS	200	0	0	200	0
CONSOLIDATED PAPERS , INC.	APPLETON	130	130	0	0	0
CONSOLIDATED PAPERS , INC.	STEVENS POINT	110	0	0	110	0
CONSOLIDATED PAPERS , INC.	WISCONSIN RAPIDS	710	0	465	245	0
GREEN BAY PACKAGING, INC.	GREEN BAY	200	0	0	0	200
FLAMBEAU PAPER CO.	PARK FALLS	115	115	0	0	0
MIDTEC PAPER CORP.	KIMBERLY	115	0	0	115	0
PENTAIR INDUSTRIES	NIAGARA	170	0	0	170	0
MOSINEE PAPER MILLS CO.	MOSINEE	200	0	200	0	0
NEKOOSA PAPERS INC.	NEKOOSA	310	0	310	0	0
NEKOOSA PAPERS INC.	PORT EDWARDS	215	215	0	0	0
OWENS-ILLINOIS	TOMAHAWK	1000	0	0	0	1000
PROCTER AND GAMBLE INC.	GREEN BAY	2/	2/	2/	2/	2/
SCOTT PAPER CO.	OCONTO FALLS	115	115	0	0	0
RHINELANDER PAPER CO.	RHINELANDER	75	75	0	0	0
FLINKOTE COMPANY	CORNELL	100	0	0	100	0
SUPERIOR FIBER PRODUCTS CO.	SUPERIOR	180	0	0	180	0
THILMANY PULP AND PAPER CO	KAUKAUNA	400	0	400	0	0
TOMAHAWK PULP CO., INC.	TOMAHAWK	50	0	0	50	0
WAUSAU PAPER MILLS CO.	BROKAW	185	185	0	0	0
BOISE CASCADE CORP.	PHILLIPS	100	0	0	100	0
TOTAL.....	24 PLANTS.....	5200	1295	1375	1330	1200
ALL STATES	41 PLANTS	11200	1295	3005	4135	2765

1/ LOCKWOOD'S DIRECTORY OF THE PAPER AND ALLIED INDUSTRIES-1979.
2/ CAPACITY NOT AVAILABLE.

Table 4.—*Production and imports of pulpwood, Central States, 1978*

(In standard cords, unpeeled)[1]

SPECIES AND DESTINATION	PRODUCTION BY STATES 2/					IMPORTS			TOTAL RECEIPTS
	ILLINOIS	INDIANA	IOWA	MISSOURI	REGIONAL TOTAL	LAKE STATES	OTHER U.S.	TOTAL IMPORTS	
SOFTWOODS									
ILLINOIS	1140	4136	0	2000	7276	0	0	0	7276
IND.,IOWA,MO. 3/	0	0	0	2400	2400	0	0	0	2400
EXPORTED 4/	5796	0	0	356	6152	0	0	0	0
TOTAL	6936	4136	0	4756	15828	0	0	0	9676
SOFT HARDWOODS									
ILLINOIS	2481	12594	114	3474	18663	2445	1453	3898	22561
IND.,IOWA,MO. 3/	4664	6687	17916	10074	39341	2830	0	2830	42171
EXPORTED 4/	4515	0	0	2702	7217	0	0	0	0
TOTAL	11660	19281	18030	16250	65221	5275	1453	6728	64732
HARD HARDWOODS									
IND.,IOWA,MO. 3/	8444	6651	3922	717	19734	5944	0	5944	25678
EXPORTED 4/	9367	18507	0	5171	33045	0	0	0	0
TOTAL	17811	25158	3922	5888	52779	5944	0	5944	25678
TOTAL ROUNDWOOD									
ILLINOIS	3621	16730	114	5474	25939	2445	1453	3898	29837
IND.,IOWA,MO. 3/	13108	13338	21838	13191	61475	8774	0	8774	70249
EXPORTED 4/	19678	18507	0	8229	46414	0	0	0	0
TOTAL	36407	48575	21952	26894	133828	11219	1453	12672	100086
RESIDUE,SOFTWOOD									
ILLINOIS	1735	0	2643	245	4623	2446	3083	5529	10152
IND.,IOWA,MO. 3/	0	0	0	0	0	0	6263	6263	6263
EXPORTED 4/	1580	0	0	2639	4219	0	0	0	0
TOTAL	3315	0	2643	2884	8842	2446	9346	11792	16415
RESIDUE,HARDWOODS									
ILLINOIS	22307	10140	7	4023	36477	7285	0	7285	43762
IND.,IOWA,MO. 3/	7511	41250	15039	18990	82790	6431	0	6431	89221
EXPORTED 4/	30012	90003	1878	46179	168072	0	0	0	0
TOTAL	59830	141393	16924	69192	287339	13716	0	13716	132983
ALL WOOD MATERIAL									
ILLINOIS	27663	26870	2764	9742	67039	12176	4536	16712	83751
IND.,IOWA,MO. 3/	20619	54588	36877	32181	144265	15205	6263	21468	165733
EXPORTED 4/	51270	108510	1878	57047	218705	0	0	0	0
TOTAL	99552	189968	41519	98970	430009	27381	10799	38180	249484

1/ FACTORS USED IN CONVERTING TO STANDARD GREEN CORDS (128 CU. FT.) WERE:
4,500 POUNDS OF SOFT HARDWOOD ROUNDWOOD;
5,000 POUNDS OF HARD HARDWOOD OR CONIFEROUS ROUNDWOOD;
4,100 POUNDS OF SOFTWOOD CHIPS (GREEN);
4,400 POUNDS OF HARDWOOD CHIPS (GREEN);
2,500 POUNDS OF CHIPS (ALL SPECIES,DRY).

2/ VERTICAL COLUMNS OF FIGURES UNDER BOX HEADING--PRODUCTION BY STATES--PRESENT THE AMOUNT OF PULPWOOD CUT IN EACH STATE.

3/ COMBINED TO PREVENT DISCLOSURE OF INDIVIDUAL MILL RECEIPTS.

4/ PULPWOOD SHIPPED TO MILLS OUTSIDE THE REGION.

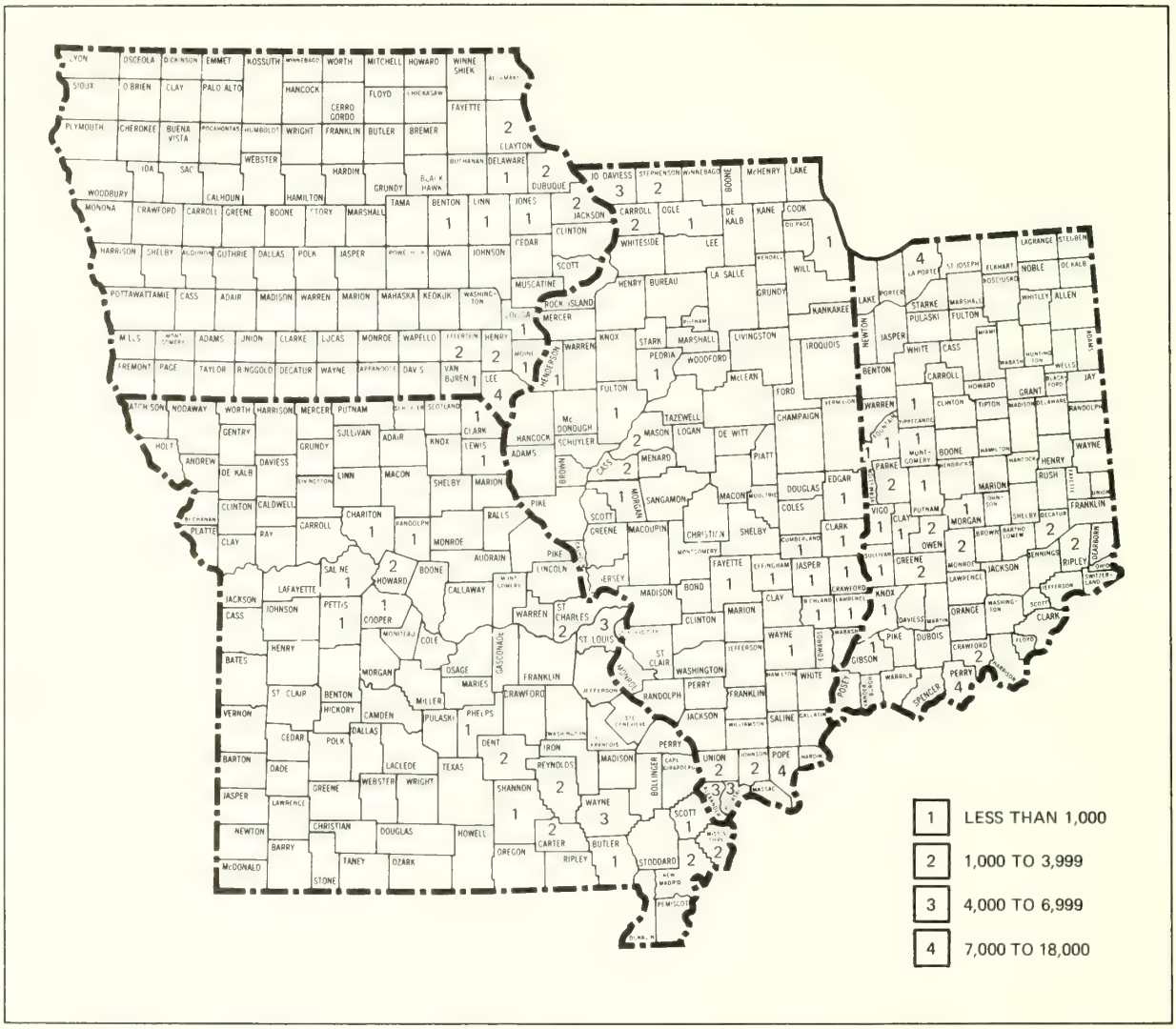


Figure 3.—*Harvest of pulpwood bolts in the Central States by counties, in standard cords, 1978.*

Logging areas expanded in northwestern Illinois, East Central Iowa, and southeastern Missouri and contracted in northeastern Illinois and northwestern Indiana.

Receipts

Twelve Central States pulpmills received 249,000 cords of pulpwood for a nominal gain over 1977. Soft hardwood receipts advanced to 65,000 cords while receipts in all other roundwood and residue groups declined. Only 15 percent of the wood was imported. All imported hardwood residue came from Lake States wood-using mills. Softwood residue imports were delivered from 14 widely scattered States.

Industry Trends and Analysis

Average daily pulp production in the Central States climbed from 1,100 tons to 1,150 tons (table 5). No mills changed ownership and no major mill capacity changes or new mill construction were announced.

Table 5.—*Active woodpulp mills in the Central States by location, type of pulp produced, and average daily production, 1978*

(In tons per 24 hours)

COMPANY	LOCATION	AVERAGE PRODUCTION IN TONS PER 24 HOURS 1/				
		TOTAL	SULFITE	KRAFT	GROUNDWOOD AND OTHER MECHANICAL	SEMI-CHEMICAL
ILLINOIS:						
BIRD AND SON, INC.	CHICAGO	40	0	0	40	0
CELOTEX CORP.	PEORIA	90	0	0	90	0
CERTAIN-TEED PRODUCTS CORP.	EAST ST LOUIS	100	0	0	100	0
FLINTKOTE CO., THE	MT CARMEL	40	0	0	40	0
GAF CORP.	JOLIET	150	0	0	150	0
JOHNS-MANVILLE PRODUCTS CORP.	WAUKEGAN	50	0	0	50	0
CELOTEX CORP.	WILMINGTON	30	0	0	30	0
TOTAL.....	7 PLANTS.....	500	0	0	500	0
INDIANA :						
WESTON PAPER AND MFG. CO.	TERRE HAUTE	270	0	0	0	270
TOTAL.....	1 PLANT.....	270	0	0	0	270
IOWA :						
CELOTEX CORP.	DUBUQUE	90	0	0	90	0
CONSOLIDATED PACKAGING CORP.	FORT MADISON	140	0	0	0	140
TOTAL.....	2 PLANTS.....	230	0	0	90	140
MISSOURI :						
GAF CORP.	KANSAS CITY	90	0	0	90	0
HUEBERT FIBREBOARD, INC.	BOONEVILLE	60	0	0	60	0
TOTAL.....	2 PLANTS.....	150	0	0	150	0
ALL STATES	12 PLANTS	1150	0	0	740	410

1/ LOCKWOOD'S DIRECTORY OF THE PAPER AND ALLIED INDUSTRIES-1979.

Pulpwood exports from the Central States are as important to producers as pulpwood produced and used in the Central States. Until 1975, when a relatively large Illinois pulpmill converted from pulpwood use to recycled paper, the dominant market for Central States pulpwood was within the Central States:

Year	Destination of Central States pulpwood: Central States	Other States
	Thousand cords	
1965	221	10
1967	245	7
1969	336	40
1971	290	131
1973	313	141
1975	210	197
1977	209	236
1978	211	219

Exports constituted less than one-fifth of the market before 1970. Then exports advanced to more than 200,000 cords by 1976 as markets opened up at new pulpmills contiguous to the area. Pulpwood produced and used in the Central States increased to more than 300,000 cords by 1968, then plummeted to about the 1965 level in 1975, where it has remained. Pulpmills near the Central States are expected to continue providing markets for at least half, and perhaps more, of the Central States pulpwood output.

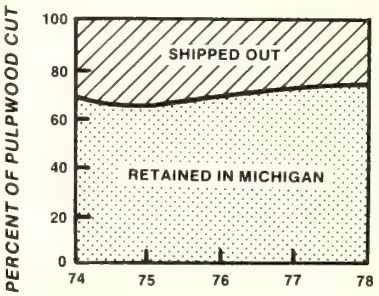
APPENDIX

Table 6.— *Lake States pulpwood production by State of origin and destination, 1974-1978*

(In thousand standard cords, unpeeled)

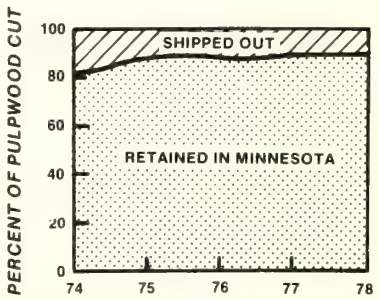
MICHIGAN

Year	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1974	1,843	—	534	1,290	19
1975	1,280	—	449	814	17
1976	1,541	—	434	1,081	26
1977	1,595	—	407	1,159	29
1978	1,675	—	404	1,248	23
5-year average	1,587	—	446	1,118	23



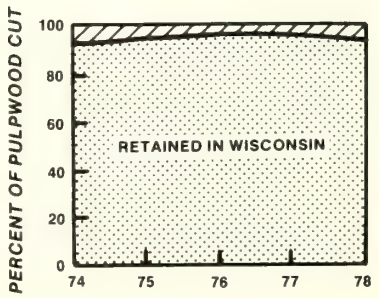
MINNESOTA

Year	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1974	1,578	1,297	262	([1])	19
1975	1,359	1,173	178	—	8
1976	1,309	1,109	182	—	18
1977	1,333	1,149	154	—	30
1978	1,338	1,155	162	—	21
5-year average	1,383	1,177	187	—	19



WISCONSIN

Year	Total cut	Destination of pulpwood			
		Minnesota	Wisconsin	Michigan	Other
1974	2,053	14	2,004	25	10
1975	1,505	20	1,460	19	6
1976	1,840	23	1,784	24	9
1977	1,816	26	1,714	64	12
1978	1,895	26	1,779	70	20
5-year average	1,822	22	1,748	40	12



[1]Less than 500 cords.

Table 7.—*Lake States pulpwood production from roundwood by Forest Survey Unit and destination by State, 1978*

(In hundred standard cords, unpeeled)

UNIT	TOTAL CUT	DESTINATION OF PULPWOOD			
		MICHIGAN	MINNESOTA	WISCONSIN	OTHER
MICHIGAN					
E. UPPER PENINSULA	3868	2502	0	1189	177
W. UPPER PENINSULA	5374	2854	0	2520	0
N. LOWER PENINSULA	5744	5579	0	160	5
S. LOWER PENINSULA	294	294	0	0	0
TOTAL ROUNDWOOD	15280	11229	0	3869	182
TOTAL RESIDUES	1471	1247	0	174	50
TOTAL	16751	12476	0	4043	232
MINNESOTA					
NORTHERN ASPEN-BIRCH	6741	0	5817	773	151
NORTHERN PINE	4939	0	4136	803	0
CENTRAL HARDWOOD	579	0	537	19	23
PRAIRIE	27	0	5	22	0
TOTAL ROUNDWOOD	12286	0	10495	1617	174
TOTAL RESIDUES	1097	0	1052	7	38
TOTAL	13383	0	11547	1624	212
WISCONSIN					
NORTHEASTERN	7056	236	18	6776	26
NORTHWESTERN	6778	98	120	6560	0
CENTRAL	2602	0	0	2602	0
SOUTHWESTERN	202	0	0	114	88
SOUTHEASTERN	70	0	0	70	0
TOTAL ROUNDWOOD	16708	334	138	16122	114
TOTAL RESIDUES	2239	368	121	1666	84
TOTAL	18947	702	259	17788	198

Table 8.—*Lake States pulpwood production from roundwood by species, State, and Forest Survey Unit, 1974-1978*

(In thousand standard cords, unpeeled)

MICHIGAN

Unit	Aspen					Balsam fir				
	Annual production					Annual production				
	1974	1975	1976	1977	1978	1974	1975	1976	1977	1978
E. Half Upper Peninsula	119	68	93	106	103	40	36	41	48	44
W. Half Upper Peninsula	294	138	176	195	220	32	34	31	45	42
N. Half Lower Peninsula	282	228	216	222	257	2	4	3	2	1
S. Half Lower Peninsula	11	1	6	9	6	—	—	—	—	—
Total	706	435	491	532	586	74	74	75	95	87
MINNESOTA										
Northern Aspen-Birch	460	357	372	375	363	52	76	44	60	59
Northern Pine	282	236	276	292	306	41	45	30	39	37
Central Hardwood	62	22	25	30	35	—	—	(1)	—	—
Prairie	—	—	—	—	—	—	—	—	—	—
Total	804	615	673	697	704	93	121	74	99	96
WISCONSIN										
Northeastern	383	286	345	334	331	49	64	61	57	53
Northwestern	342	276	308	329	300	35	33	26	15	21
Central	71	25	38	31	37	1	1	2	1	1
Southwestern	1	—	—	1	1	—	—	—	—	—
Southeastern	(1)	1	2	1	(1)	—	—	—	—	(1)
Total	797	588	693	696	669	85	98	89	73	75
Lake States	2,307	1,638	1,857	1,925	1,959	252	293	238	267	258

MICHIGAN

Unit	Birch					Hemlock				
	Annual production					Annual production				
	1974	1975	1976	1977	1978	1974	1975	1976	1977	1978
E. Half Upper Peninsula	24	6	20	22	28	13	16	35	31	24
W. Half Upper Peninsula	35	8	29	29	46	39	34	44	31	24
N. Half Lower Peninsula	25	22	20	11	16	(1)	—	(1)	(1)	(1)
S. Half Lower Peninsula	(1)	(1)	(1)	(1)	(1)	—	—	—	—	—
Total	84	36	69	62	90	52	50	79	62	48
MINNESOTA										
Northern Aspen-Birch	15	16	21	15	2	—	—	—	—	—
Northern Pine	24	18	23	13	5	—	—	—	—	—
Central Hardwood	5	2	2	2	2	—	—	—	—	—
Prairie	(1)	(1)	—	—	—	—	—	—	—	—
Total	44	36	46	30	9	—	—	—	—	—
WISCONSIN										
Northeastern	38	33	50	54	62	32	30	27	32	30
Northwestern	59	44	56	44	53	9	13	9	8	19
Central	5	6	8	5	6	3	3	7	3	4
Southwestern	(1)	(1)	—	(1)	(1)	—	—	—	—	—
Southeastern	(1)	(1)	(1)	(1)	(1)	1	(1)	—	—	—
Total	102	83	114	103	121	45	46	43	43	53
Lake States	230	155	229	195	220	97	96	122	105	101

(Table 8 continued on next page)

(Table 8 continued)

MICHIGAN

Unit	Pine — Annual production					Spruce — Annual production				
	1974	1975	1976	1977	1978	1974	1975	1976	1977	1978
E. Half Upper Peninsula	87	59	88	82	85	19	18	17	27	25
W. Half Upper Peninsula	36	25	43	49	50	20	25	14	21	18
N. Half Lower Peninsula	127	143	140	119	122	1	2	1	([1])	([1])
S. Half Lower Peninsula	9	8	10	12	20	—	—	—	—	—
Total	259	235	281	262	277	40	45	32	48	43
MINNESOTA										
Northern Aspen-Birch	139	116	104	97	89	154	153	129	110	126
Northern Pine	98	79	64	73	89	51	49	46	43	38
Central Hardwood	2	4	4	4	8	([1])	—	([1])	([1])	([1])
Prairie	([1])	—	—	—	—	2	—	—	—	([1])
Total	239	199	172	174	186	207	202	175	153	164
WISCONSIN										
Northeastern	62	46	55	68	98	13	18	14	16	16
Northwestern	100	64	96	103	122	6	7	4	3	3
Central	125	122	124	113	121	([1])	([1])	1	([1])	([1])
Southwestern	2	2	5	8	11	—	—	—	—	—
Southeastern	2	5	6	4	5	([1])	—	—	—	—
Total	291	239	286	296	357	19	25	19	19	19
Lake States	789	673	739	732	820	266	272	226	220	226

MICHIGAN

Unit	Tamarack — Annual production					Other hardwoods — Annual production				
	1974	1975	1976	1977	1978	1974	1975	1976	1977	1978
E. Half Upper Peninsula	1	1	([1])	2	1	124	35	82	69	73
W. Half Upper Peninsula	1	1	1	1	1	148	57	88	84	134
N. Half Lower Peninsula	—	—	—	—	—	144	124	147	162	179
S. Half Lower Peninsula	—	—	—	—	—	8	2	3	18	3
Total	2	2	1	3	2	424	218	320	333	389
MINNESOTA										
Northern Aspen-Birch	25	31	19	24	18	24	12	19	12	17
Northern Pine	18	25	17	15	10	6	7	7	5	9
Central Hardwood	—	([1])	([1])	([1])	—	6	3	6	8	13
Prairie	([1])	([1])	1	3	2	([1])	—	—	—	—
Total	43	56	37	42	30	36	22	32	25	39
WISCONSIN										
Northeastern	1	2	2	2	2	183	89	158	152	113
Northwestern	1	1	1	1	1	140	81	122	104	159
Central	([1])	1	([1])	1	([1])	174	71	140	121	91
Southwestern	—	—	—	—	—	3	2	3	4	8
Southeastern	—	—	—	—	—	6	1	2	2	2
Total	2	4	3	4	3	506	244	425	383	373
Lake States	47	62	41	49	35	966	484	777	741	801

(Table 8 continued on next page)

(Table 8 continued)

Unit	All species[2] Annual production 1974	1975	1976	1977	1978
MICHIGAN					
E. Half Upper Peninsula	430	241	379	390	387
W. Half Upper Peninsula	607	323	428	458	537
N. Half Lower Peninsula	581	523	527	516	575
S. Half Lower Peninsula	28	11	19	39	29
Total	1,646	1,098	1,353	1,403	1,528
MINNESOTA					
Northern Aspen-Birch	869	761	708	693	674
Northern Pine	520	459	463	480	494
Central Hardwood	75	31	37	44	58
Prairie	2	([1])	1	3	2
Total	1,466	1,251	1,209	1,220	1,228
WISCONSIN					
Northeastern	761	568	712	716	706
Northwestern	692	519	622	608	678
Central	379	229	320	275	260
Southwestern	6	4	8	13	20
Southeastern	9	7	10	7	7
Total	1,847	1,327	1,672	1,619	1,671
Lake States	4,959	3,676	4,234	4,242	4,427

[1]Less than 500 cords.

[2]Includes small quantity of cedar not shown in other parts of table.

Table 9.—*Lake States pulpwood production from roundwood by county and species, 1978*
(In standard cords, unpeeled)

MICHIGAN

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMA RACK	ASH	ASPEN	BALSAM POPLAR	BASS WOOD
E. UPPER PENINSULA												
ALGER	440	3421	5937	5665	1594	784	1165	57	76	4015	1203	32
CHIPPEWA	227	4043	971	13359	1063	530	3500	226	5	4276	475	9
DELTA	1315	11561	3943	6655	3828	1456	4454	264	448	35102	3619	136
LUCE	156	5394	5246	25281	1686	868	4404	140	87	3427	630	0
MACKINAC	144	4972	750	4815	666	329	4071	17	45	5575	1183	22
MENOMINEE	1130	10727	4333	1463	815	593	4718	353	1519	38025	2168	32
SCHOOLCRAFT	376	3709	2663	11777	1449	724	2212	160	88	12937	2460	5
TOTAL	3788	43827	23843	69015	11101	5284	24524	1217	2268	103357	11738	236
W. UPPER PENINSULA												
BARAGA	71	3434	4345	590	1519	748	1191	22	161	22271	856	136
DICKINSON	205	4491	1258	470	659	312	1908	76	754	71673	3689	110
GOGEBIC	35	2237	3023	541	1109	408	485	37	93	13267	0	18
HOUGHTON	108	1166	1417	4313	713	152	737	14	133	3371	0	32
IRON	618	15779	4205	6508	3382	906	7604	199	514	44991	71	252
KEWEENAW	0	88	727	16	43	20	141	0	18	2	0	12
MARQUETTE	1275	12419	5867	17698	4298	2228	4812	185	330	27518	3948	152
ONTONAGON	12	2979	3473	1747	1623	645	815	0	1550	36296	0	1745
TOTAL	2324	42593	24315	31883	13346	5419	17693	533	3553	219389	8564	2457
N. LOWER PENINSULA												
ALCONA	0	43	25	2535	140	25	30	0	370	29629	1487	65
ALPENA	0	130	0	2167	8	1	50	0	920	12439	666	111
ANTRIM	0	0	0	113	0	0	0	0	0	0	0	0
ARENAC	0	0	0	0	0	0	0	0	0	118	0	0
BENZIE	0	0	0	0	0	0	0	0	52	6849	0	104
CHARLEVOIX	0	0	0	0	0	0	0	0	0	158	0	48
CHEBOYGAN	0	64	7	4286	347	19	22	0	860	9015	488	89
CLARE	0	0	0	1572	0	0	0	0	193	28432	0	115
CRAWFORD	0	23	0	11292	56	8	9	0	26	2450	0	24
EMMET	0	0	0	0	0	0	0	0	0	22	0	0
GLADWIN	0	0	0	0	0	0	0	0	113	3830	0	104
GRAND TRAVERSE	0	0	0	1983	0	0	0	0	26	2808	0	52
IOSCO	0	0	0	10024	865	4	5	0	62	1367	67	0
ISABELLA	0	0	0	0	24	0	0	0	11	5580	0	0
KALKASKA	0	0	0	2045	238	2	0	0	27	2218	0	26
LAKE	0	0	0	6462	0	0	0	0	177	11220	0	10
LEELANAU	0	0	0	145	0	0	0	0	0	0	0	0
MANISTEE	0	0	0	0	1221	0	0	0	118	6987	0	104
MASON	0	0	0	0	2298	0	0	0	115	10004	0	104
MECOSTA	0	0	0	0	2932	0	0	0	156	8289	0	0
MIDLAND	0	0	0	0	0	0	0	0	0	2644	0	21
MISSAUKEE	0	0	0	468	469	0	0	0	34	3120	0	156
MONTMORENCY	0	103	0	5452	74	8	62	0	720	21426	1110	67
NEWAYGO	0	0	0	0	5980	0	0	0	237	13188	0	0
OCEANA	0	0	0	0	1679	0	0	0	108	13379	0	104
OGEMAW	0	0	0	3352	0	0	0	0	87	3621	89	26
OSCEOLA	0	0	0	0	3143	0	0	0	259	13462	0	52
OSCODA	0	50	20	12810	37	7	9	0	140	12358	444	21
OTSEGO	0	29	67	3841	220	25	20	0	0	1562	67	0
PRESQUE ISLE	0	430	78	3715	75	12	36	0	180	10221	555	22
ROSCOMMON	0	0	4	6036	11	1	1	0	5	7067	22	52
WEXFORD	0	50	54	11954	10989	21	24	0	138	13387	0	104
TOTAL	0	922	255	90252	30709	133	278	0	5114	256850	4975	1510
S. LOWER PENINSULA												
ALLEGAN	0	0	0	857	857	0	0	0	0	20	0	0
BARRY	0	0	0	0	689	0	0	0	0	138	0	0
CASS	0	0	0	0	23	0	0	0	0	0	0	0
GRATIOT	0	0	0	0	10	0	0	0	0	1423	0	0
IONIA	0	0	0	0	196	0	0	0	0	0	0	0
KALAMAZOO	0	0	0	0	76	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	55	1130	0	0
LIVINGSTON	0	0	0	0	0	0	0	0	0	0	0	0
MONTCALM	0	0	0	0	1397	0	0	0	59	1884	0	0
MUSKEGON	0	0	0	0	4743	0	0	0	13	1087	0	0
OAKLAND	0	0	0	0	14	0	0	0	0	0	0	0
OTTAWA	0	0	0	0	10658	0	0	0	2	132	0	0
SHIAWASSEE	0	0	0	0	116	0	0	0	0	0	0	0
VAN BUREN	0	0	0	0	0	0	0	0	0	0	0	0
WASHTENAW	0	0	0	0	98	0	0	0	0	0	0	0
TOTAL	0	0	0	857	18881	0	0	0	137	6012	0	0
STATE TOTAL	6112	87342	48413	192007	74037	10836	42495	1750	11072	585608	25297	4276

(TABLE 9 CONTINUED ON NEXT PAGE)

(TABLE 9 CONTINUED)

MICHIGAN

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD WOODS	ALL SPECIES
E. UPPER PENINSULA												
ALGER	1503	2662	616	0	680	0	3145	3428	70	0	87	36580
CHIPPEWA	614	1247	216	0	103	0	368	896	20	0	25	32173
DELTA	364	7247	1911	0	2160	0	6149	7793	255	43	227	98930
LUCE	1999	1684	191	0	265	0	1762	1459	69	0	41	54789
MACKINAC	445	1235	86	0	106	0	749	900	39	0	0	26149
MENOMINEE	140	5483	734	0	1640	0	4905	6579	81	209	95	85742
SCHOOLCRAFT	2523	4309	125	0	667	0	816	5155	103	0	129	52387
TOTAL	7588	23867	3879	0	5621	0	17894	26210	637	252	604	386750
W. UPPER PENINSULA												
BARAGA	0	2607	2816	0	3426	0	9421	3840	75	0	605	58134
DICKINSON	73	8328	294	0	1241	0	3470	6075	70	105	179	105440
GOGEBIC	0	390	1622	0	1596	0	3361	1294	0	0	316	29832
HOUGHTON	0	933	2042	0	2136	0	4561	1988	12	0	411	24239
IRON	0	3695	4815	0	5726	0	11816	6292	88	0	1144	118605
KEWEENAW	0	27	55	0	65	0	243	69	0	0	12	1538
MARQUETTE	190	9677	1830	0	2452	0	10340	9808	417	0	335	115779
ONTONAGON	0	1701	5042	0	3712	0	16899	5201	8	0	418	83866
TOTAL	263	27358	18516	0	20354	0	60111	34567	670	105	3420	537433
N. LOWER PENINSULA												
ALCONA	81	2476	0	0	0	0	122	2622	8463	894	52	49059
ALPENA	140	960	0	0	0	0	200	3818	1610	183	0	23403
ANTRIM	0	0	0	0	0	0	0	0	0	0	0	113
ARENAC	0	0	0	0	0	0	0	29	0	0	0	147
BENZIE	104	447	0	0	0	0	104	2080	502	104	52	10398
CHARLEVOIX	26	0	0	0	0	0	26	572	52	26	26	934
CHEBOYGAN	120	864	0	0	0	0	220	3552	329	37	0	20319
CLARE	327	1108	0	0	0	0	241	3028	3714	3206	255	42191
CRAWFORD	42	92	0	0	0	0	46	564	1286	644	106	16670
EMMET	0	0	0	0	0	0	0	0	0	0	0	22
GLADWIN	52	537	0	0	0	0	38	1515	659	196	26	7070
GRAND TRAVERSE	80	113	0	0	0	0	52	728	104	52	26	6024
IOSCO	20	79	0	0	0	0	23	281	2439	363	0	15599
ISABELLA	5	213	0	0	0	0	18	23	61	14	2	5951
KALKASKA	26	457	0	0	0	0	27	1255	230	59	52	6662
LAKE	39	181	0	0	0	0	208	3509	12784	1771	106	36467
LEELANAU	0	0	0	0	0	0	0	0	0	0	0	145
MANISTEE	104	191	0	0	0	0	227	4775	5345	871	185	20128
MASON	111	360	0	0	0	0	129	3737	4783	748	126	22515
MECOSTA	135	33	0	0	0	0	405	423	969	274	44	13660
MIDLAND	21	551	0	0	0	0	0	1673	21	21	21	4973
MISSAUKEE	156	271	0	0	0	0	104	1040	416	416	104	6754
MONTMORENCY	109	1233	0	0	0	0	180	3313	5931	770	12	40570
NEWAYGO	207	99	0	0	0	0	472	1452	8916	2886	195	33632
OCEANA	127	190	0	0	0	0	210	1213	2113	545	57	19725
OGEMAW	26	340	0	0	0	0	48	923	2091	332	94	11029
OSCEOLA	310	452	0	0	0	0	727	5208	2758	586	107	27064
OSCODA	103	632	0	0	0	0	21	1733	4241	1254	66	33946
OTSEGO	52	28	0	0	0	0	0	1120	775	159	52	8030
PRESQUE ISLE	20	3398	0	0	0	0	40	1576	256	37	0	20631
ROSCOMMON	42	359	0	0	0	0	7	1594	7566	577	104	23448
WEXFORD	111	395	0	0	0	0	162	5566	3331	789	106	47081
TOTAL	2696	16059	0	0	0	0	4057	58922	81745	17814	1976	574360
S. LOWER PENINSULA												
ALLEGAN	0	8	0	0	0	0	10	51	360	77	0	2434
BARRY	0	0	0	0	0	0	0	0	0	0	0	827
CASS	0	0	0	0	0	0	0	0	0	0	0	23
GRATIOT	0	0	0	0	0	0	0	0	8	5	0	1452
IONIA	0	0	0	0	0	0	0	0	0	0	0	176
KALAMAZOO	0	0	0	0	0	0	0	0	0	0	0	76
KENT	20	10	0	0	0	0	57	144	587	177	14	2194
LIVINGSTON	0	0	0	0	0	0	0	2	10	2	0	14
MONTCALM	20	7	0	0	0	0	55	143	553	198	20	4336
MUSKEGON	0	13	0	0	0	0	17	86	599	128	0	6686
OAKLAND	0	0	0	0	0	0	0	0	0	0	0	14
OTTAWA	0	2	0	0	0	0	2	10	72	15	0	10899
SHIAWASSEE	0	0	0	0	0	0	0	0	0	0	0	116
VAN BUREN	0	0	0	0	0	0	0	0	0	0	0	9
WASHTENAW	0	0	0	0	0	0	0	0	0	0	0	93
TOTAL	40	40	0	0	0	0	141	436	2189	602	34	29369
STATE TOTAL	10587	67324	22395	0	25975	0	82203	120135	85241	18773	6034	1527912

(TABLE 9 CONTINUED ON NEXT PAGE)

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMA RACK	ASH	ASPEN	BALSAM POPLAR	BASS WOOD
NORTHERN ASPEN BIRCH												
CARLTON	0	2223	0	2385	546	312	3085	134	0	16791	0	0
COOK	0	4996	0	6007	5	0	11455	0	0	3035	0	0
KOOCHICHING	0	26311	0	12866	2208	1224	66144	15720	729	121661	9638	81
LAKE	0	4816	0	18927	849	208	17965	0	0	24739	0	0
ST.LOUIS	0	20612	0	36027	5859	1672	27510	2114	129	196587	5615	0
TOTAL	0	58958	0	76212	9467	3416	126159	17968	858	362813	15253	81
NORTHERN PINE												
AITKIN	0	1363	0	1456	0	208	2288	3052	209	47871	0	0
BECKER	0	0	0	1686	104	0	0	0	0	520	0	0
BELTRAMI	0	10713	0	14102	1904	251	9660	1654	0	42631	53	0
CASS	0	1312	0	16206	1219	367	695	943	165	52488	0	0
CLEARWATER	0	1153	0	2071	291	0	1406	1767	0	10550	0	0
CROW WING	0	5	0	7800	0	0	14	0	0	9060	0	0
HUBBARD	0	254	0	10658	489	188	606	176	0	30254	0	0
ITASCA	0	21544	0	6513	675	226	10708	2328	1247	97204	1463	0
LAKE OF THE WOODS	0	312	0	7013	96	0	8531	385	0	7253	31	0
MAHNOMEN	0	0	0	1092	53	0	0	164	0	520	0	0
ROSEAU	0	125	0	6503	0	0	3750	25	0	5084	0	0
WADENA	0	58	0	7224	480	104	0	0	0	2867	0	0
TOTAL	0	36839	0	82324	5311	1344	37658	10494	1621	306302	1547	0
CENTRAL HARDWOOD												
BENTON	0	0	0	0	0	0	0	0	0	61	0	0
CHISAGO	0	0	0	0	0	0	0	0	0	208	0	0
HENNEPIN	0	0	0	0	0	0	0	0	0	0	0	0
ISANTI	0	0	0	1508	0	0	0	0	0	0	0	0
KANABEC	0	0	0	572	0	0	0	0	0	3722	0	0
MILLE LACS	0	0	0	0	0	0	0	0	0	10080	0	0
MORRISON	0	0	0	1707	110	0	1	0	0	6275	0	0
OTTER TAIL	0	0	0	1040	0	0	0	0	0	520	0	0
PINE	0	0	0	1163	0	0	17	0	0	13668	0	0
RAMSEY	0	0	0	0	0	0	0	0	0	0	0	0
SHERBURNE	0	0	0	0	0	0	36	0	0	0	0	0
TODD	0	0	0	1488	45	0	0	0	0	208	0	0
TOTAL	0	0	0	7478	155	0	54	0	0	34742	0	0
PRAIRIE												
POLK	0	0	0	0	0	0	34	2194	0	520	0	0
TOTAL	0	0	0	0	0	0	34	2194	0	520	0	0
STATE TOTAL	0	95797	0	166014	14933	4760	163905	30656	2479	704377	16800	81

(TABLE 9 CONTINUED ON NEXT PAGE)

(TABLE 9 CONTINUED)

MINNESOTA

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD WOODS	ALL SPECIES
NORTHERN ASPEN BIRCH												
CARLTON	0	171	0	0	0	0	35	22	0	0	0	25704
COOK	0	0	0	0	0	0	0	0	0	0	0	25498
KOOCHICHING	0	430	0	0	367	0	10	48	0	0	0	257437
LAKE	0	519	0	0	0	0	25	5	0	0	0	68053
ST.LOUIS	0	978	2	0	107	0	31	89	3	0	0	297335
TOTAL	0	2098	2	0	474	0	101	164	3	0	0	674027
NORTHERN PINE												
AITKIN	0	600	3	0	207	0	120	469	1315	0	0	59161
BECKER	0	0	0	0	0	0	0	0	0	0	0	2310
BELTRAMI	0	571	0	0	0	0	72	34	0	0	0	81645
CASS	0	819	0	0	336	0	51	60	335	0	0	74996
CLEARWATER	0	37	0	0	0	0	6	2	0	0	0	17283
CROW WING	0	0	0	0	0	0	0	0	0	0	0	16879
HUBBARD	0	0	0	0	0	0	0	0	0	0	0	42625
ITASCA	0	2832	31	0	1657	0	328	230	311	0	0	147297
LAKE OF THE WOODS	0	0	0	0	0	0	0	0	0	0	0	23621
MAHNOMEN	0	0	0	0	0	0	0	0	0	0	0	1829
ROSEAU	0	0	0	0	0	0	0	0	0	0	0	15487
WADENA	0	0	0	0	0	0	0	0	0	0	0	10733
TOTAL	0	4859	34	0	2200	0	577	795	1961	0	0	493866
CENTRAL HARDWOOD												
BENTON	0	0	0	0	0	0	0	0	0	0	0	61
CHISAGO	0	0	0	0	0	0	0	0	0	0	0	208
HENNEPIN	0	0	0	0	2858	0	0	0	0	0	0	2858
ISANTI	0	0	0	0	0	0	0	0	0	0	0	1508
KANABEC	0	407	0	0	0	0	0	407	1221	0	0	6329
MILLE LACS	0	1225	0	0	0	0	0	1225	3677	0	0	16207
MORRISON	0	407	0	0	0	0	0	407	1221	0	0	10128
OTTER TAIL	0	0	0	0	0	0	0	0	0	0	0	1560
PINE	0	196	0	0	0	0	0	0	196	0	0	15240
RAMSEY	0	0	0	0	1968	0	0	0	0	0	0	1968
SHERBURNE	0	0	0	0	0	0	0	0	0	0	0	36
TODD	0	0	0	0	0	0	0	0	0	0	0	1741
TOTAL	0	2235	0	0	4826	0	0	2039	6315	0	0	57844
PRAIRIE												
POLK	0	0	0	0	0	0	0	0	0	0	0	2748
TOTAL	0	0	0	0	0	0	0	0	0	0	0	2748
STATE TOTAL	0	9192	36	0	7500	0	678	2998	8279	0	0	1228485

(TABLE 9 CONTINUED ON NEXT PAGE)

UNIT AND COUNTY 1/	CEDAR	BALSAM FIR	HEMLOCK	JACK PINE	RED PINE	WHITE PINE	SPRUCE	TAMA RACK	ASH	ASPEN	BALSAM POPLAR	BASS WOOD
NORTHEASTERN												
FLORENCE	0	2190	453	1207	4721	318	1221	46	221	35446	4	177
FOREST	200	16338	4462	2023	6428	330	3144	77	1504	44977	48	881
LANGLADE	0	2471	776	329	1525	59	231	422	1514	17502	0	586
LINCOLN	296	4026	1754	1973	2346	459	1771	330	843	30212	0	1319
MARINETTE	108	4771	1855	7024	11777	756	1685	43	1602	57182	0	249
OCONTO	0	2522	170	2877	10573	559	271	0	141	15478	33	5
ONEIDA	56	14395	1461	11758	14226	1154	6596	336	1779	67703	0	2393
SHAWANO 2/	0	63	17632	2812	3827	237	133	0	375	23652	38	43
VILAS	9	6024	1558	3544	3943	1295	1599	88	242	38601	2	260
TOTAL	669	52800	30121	33547	59366	5167	16651	1342	8221	330753	125	5913
NORTHWESTERN												
ASHLAND	184	7551	1735	2374	2394	568	896	28	1414	45857	10	1433
BARRON	0	0	0	210	111	0	0	0	846	412	0	119
BAYFIELD	0	1734	85	13275	3762	614	190	0	276	34177	0	193
BURNETT	0	63	0	17063	2250	692	0	30	123	722	0	5
DOUGLAS	0	1053	0	35935	1398	190	81	35	15	28224	0	11
IRON	17	1989	895	107	130	149	222	18	129	45582	0	297
POLK	0	0	0	1987	269	69	0	25	0	829	0	0
PRICE	233	5472	3480	1112	3116	416	967	835	3428	45352	27	1913
RUSK	0	65	148	441	64	16	1	19	966	12019	0	419
SAWYER	56	1197	10461	3518	2799	281	116	8	2439	39213	0	849
TAYLOR	0	1928	1591	379	526	11	132	223	758	20174	0	640
WASHBURN	0	30	0	21606	3140	795	82	9	54	27266	0	31
TOTAL	490	21082	18395	98007	19959	3801	2687	1230	10448	299827	37	5910
CENTRAL												
ADAMS	0	0	0	22130	4393	1177	0	0	67	179	0	31
CHIPPEWA	0	62	183	730	315	20	0	42	756	8797	0	574
CLARK	0	82	394	1382	980	852	0	0	322	4427	0	130
EAU CLAIRE	0	0	0	2399	967	7	0	0	363	403	0	27
JACKSON	0	0	0	10364	2822	280	0	15	84	58	0	32
JUNEAU	0	0	0	17134	4492	502	0	0	80	676	0	14
MARATHON	0	986	2919	1000	1624	131	32	9	276	11717	0	202
MARQUETTE	0	0	0	3234	1059	450	0	243	184	156	0	140
MONROE	0	0	0	4461	2250	126	0	0	47	10	0	15
PORTAGE	0	38	206	4303	3170	1574	10	27	76	2499	0	60
WAUPACA	0	18	0	1766	4537	500	0	104	147	4582	0	16
WAUSHARA	0	0	0	2777	4369	671	0	0	19	336	0	6
WOOD	0	0	0	9592	1473	1543	185	7	182	2645	0	122
TOTAL	0	1186	3702	81272	32451	7833	227	447	2603	36485	0	1369
SOUTHWESTERN												
BUFFALO	0	0	0	215	214	12	0	0	0	0	0	0
CRAWFORD	0	0	0	0	0	0	0	0	0	269	0	106
DUNN	0	0	0	1611	2356	62	0	0	0	0	0	0
GRANT	0	0	0	0	0	0	0	0	0	809	0	333
IOWA	0	0	0	37	104	62	0	0	0	131	0	54
LACROSSE	0	0	0	543	668	56	0	0	0	0	0	0
LAFAYETTE	0	0	0	0	0	0	0	0	0	134	0	56
PEPIN	0	0	0	44	38	14	0	0	0	0	0	0
PIERCE	0	0	0	3	4	0	0	0	0	0	0	0
SAUK	0	0	0	648	991	117	0	0	27	0	0	0
TREMPEALEAU	0	0	0	1252	1197	548	0	0	0	38	0	0
VERNON	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	4353	5572	872	0	0	27	1381	0	549
SOUTHEASTERN												
BROWN	0	0	0	60	241	16	0	0	0	201	0	0
COLUMBIA	0	0	0	360	2080	225	0	0	58	0	0	43
DOOR	0	0	0	62	245	16	0	0	0	0	0	0
GREEN	0	0	0	26	276	17	0	0	0	0	0	0
GREEN LAKE	0	0	0	15	23	1	0	0	0	0	0	0
JEFFERSON	0	0	0	11	3	0	0	0	0	0	0	0
KENOSHA	0	0	0	0	0	0	0	0	0	24	0	0
MANITOWOC	0	0	0	0	0	0	0	0	0	11	0	0
OUTAGAMIE	0	73	0	8	60	6	0	0	9	12	0	0
WAUKESHA	0	0	0	303	1110	73	0	0	1	0	0	0
TOTAL	0	73	0	845	4038	354	0	0	68	248	0	43
STATE TOTAL	1159	75141	52218	218024	121386	18027	19565	3019	21362	668694	162	13784

(TABLE 9 CONTINUED ON NEXT PAGE)

(TABLE 9 CONTINUED)

WISCONSIN

UNIT AND COUNTY 1/	BEECH	WHITE BIRCH	YELLOW BIRCH	COTTON WOOD	ELM	HICKORY	HARD MAPLE	SOFT MAPLE	RED OAK	WHITE OAK	OTHER HARD WOODS	ALL SPECIES
NORTHEASTERN												
FLORENCE	0	732	714	0	1435	0	2326	560	18	0	60	51849
FOREST	1	4286	2392	0	9967	0	8119	2241	23	0	502	107943
LANGLADE	0	2440	1256	0	8994	35	9756	3638	545	0	695	52774
LINCOLN	0	1764	235	0	2286	0	1630	1326	1256	0	66	53892
MARINETTE	0	11995	545	0	2961	0	2149	3299	1130	283	358	109772
OCONTO	14	2026	162	0	508	0	795	855	27	0	3	37019
ONEIDA	0	17713	1598	0	2005	5	2931	4059	3554	0	266	153988
SHAWANO 2/	87	854	400	0	4527	455	3642	2294	715	0	348	62134
VILAS	0	10078	2396	0	1660	0	3097	1399	324	6	77	76202
TOTAL	102	51838	9698	0	34343	495	34445	19671	7592	289	2375	705573
NORTHWESTERN												
ASHLAND	0	4479	2216	0	3883	0	4486	2692	2147	0	170	84517
BARRON	0	1226	359	0	473	0	1634	972	1459	0	54	7875
BAYFIELD	0	8094	517	0	1085	0	707	449	0	0	59	65217
BURNETT	0	760	122	0	372	0	614	612	0	0	2	23430
DOUGLAS	0	2229	16	0	92	0	103	84	0	0	3	69469
IRON	0	1480	2893	0	14938	0	10387	9530	1501	0	12	90276
POLK	0	0	0	0	0	0	0	0	0	0	0	3179
PRICE	0	9290	2275	0	16951	0	7856	5417	1528	21	216	109905
RUSK	0	2621	509	0	1449	0	2162	1327	673	10	66	22975
SAWYER	0	8127	1776	0	10886	0	8829	6647	1675	0	224	99101
TAYLOR	0	2620	806	0	9258	0	4824	3683	149	7	94	47803
WASHBURN	0	431	53	0	144	0	244	198	0	0	9	54092
TOTAL	0	41357	11542	0	59531	0	41846	31611	9132	38	909	677839
CENTRAL												
ADAMS	0	275	56	0	246	0	235	398	5172	1415	10	35784
CHIPPEWA	0	1372	591	0	1058	0	1290	1834	1104	0	42	18770
CLARK	1	413	146	0	1165	0	1215	1698	7367	1876	51	22501
EAU CLAIRE	0	552	115	0	281	0	419	954	3559	10	64	10120
JACKSON	0	208	49	0	266	0	210	380	950	257	17	15992
JUNEAU	0	219	50	0	284	0	251	369	4034	1188	8	29301
MARATHON	0	655	229	0	10733	33	7636	7896	992	0	59	47129
MARQUETTE	0	87	18	0	147	0	673	2205	238	72	44	8950
MONROE	0	175	36	0	330	0	288	362	167	47	4	8318
PORTAGE	0	55	25	0	148	0	415	737	1936	556	18	15853
WAUPACA	0	207	99	0	835	97	531	377	243	0	70	14129
WAUSHARA	0	84	18	0	73	0	83	112	119	34	2	8703
WOOD	0	163	44	0	305	0	723	1695	4574	1346	39	24638
TOTAL	1	4465	1476	0	15871	130	13969	19017	30455	6801	428	260188
SOUTHWESTERN												
BUFFALO	0	0	0	0	0	0	0	0	0	0	0	441
CRAWFORD	0	43	0	20	0	0	0	128	862	327	0	1755
DUNN	0	0	0	0	0	0	0	0	0	0	0	4029
GRANT	0	135	0	53	0	0	0	368	2593	974	0	5265
IOWA	0	21	0	9	0	0	0	68	432	162	0	1081
LACROSSE	0	0	0	0	0	0	0	0	0	0	0	1267
LAFAYETTE	0	21	0	9	0	0	0	63	433	161	0	877
PEPIN	0	0	0	0	0	0	0	0	0	0	0	96
PIERCE	0	0	0	0	0	0	0	0	0	0	0	7
SAUK	0	126	26	0	79	0	127	127	10	4	0	2282
TREMPEALEAU	0	0	0	0	0	0	0	0	0	0	0	3035
VERNON	0	0	0	0	20	0	10	10	0	0	0	40
TOTAL	0	346	26	91	99	0	137	764	4330	1628	0	20175
SOUTHEASTERN												
BROWN	0	0	0	0	0	0	0	0	0	0	0	518
COLUMBIA	0	11	0	0	87	0	494	384	83	56	12	3888
DOOR	0	0	0	0	0	0	0	0	0	0	0	323
GREEN	0	0	0	0	0	0	0	0	0	0	0	319
GREEN LAKE	0	0	0	0	0	0	0	0	0	0	0	39
JEFFERSON	0	0	0	0	0	0	0	0	0	0	0	14
KENOSHA	0	0	0	0	0	0	0	0	0	0	0	24
MANITOWOC	0	0	0	0	0	0	0	0	0	0	0	11
OUTAGAMIE	0	48	7	0	29	0	48	48	0	0	0	350
WAUKESHA	0	3	1	0	2	0	3	3	0	0	0	1499
TOTAL	0	62	10	0	118	0	545	435	83	56	12	6985
STATE TOTAL	103	98118	22752	91	109962	625	90942	71498	51592	8812	3724	1670760

1/ INCLUDES ONLY THOSE COUNTIES THAT SUPPLIED PULPWOOD IN 1978.
2/ INCLUDES MENOMINEE COUNTY.

Table 10.—*Central States pulpwood production by State and destination, 1974-1978*

(In thousand standard cords, unpeeled)

Year	Illinois			Indiana			Iowa			Missouri		
	Destination			Destination			Destination			Destination		
	Total	Central States	Other States	Total	Central States	Other States	Total	Central States	Other States	Total	Central States	Other States
1974	131	98	33	159	84	75	59	57	2	137	77	60
1975	105	60	45	135	58	77	50	48	2	116	43	73
1976	116	65	51	172	78	94	45	41	4	132	55	77
1977	111	53	58	161	66	95	50	46	4	123	44	79
1978	100	49	51	190	81	109	42	40	2	99	42	57

Table 11.—*Trends in receipts of roundwood and residue as pulpwood, Central States, 1974-1978*

(In thousand standard cords, unpeeled)

Type of material and area	1974	1975	1976	1977	1978
Roundwood:					
Illinois	56	13	18	24	30
Indiana, Iowa, Missouri	93	74	81	62	70
Total	149	86	99	86	100
Residue:					
Illinois	104	64	71	62	54
Indiana, Iowa, Missouri	100	86	102	98	95
Total	204	150	173	160	149
All material	353	236	272	246	249

☆ U.S. Government Printing Office: 1980—669-259/57 Region No. 6

Blyth, James E., and W. Brad Smith.
1980. Pulpwood production in the north central region by county, 1978. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-50, 23 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

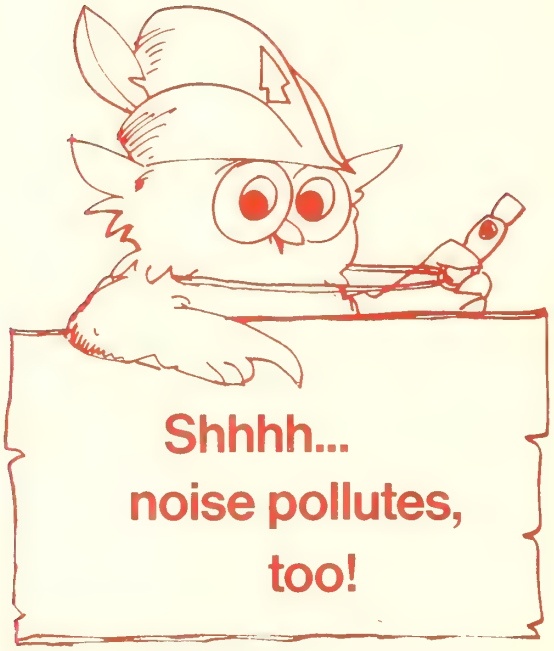
Discusses 1978 production and receipts and recent production for other years in the Lake and Central States. Shows Michigan, Minnesota, and Wisconsin production by species for each county and compares production by Forest Survey Unit with that of previous years. Presents 1978 production and receipts data for Illinois, Indiana, Iowa, and Missouri, and shows four production classes by county.

KEY WORDS: roundwood, residue, receipts, Lake States, Central States.

Blyth, James E., and W. Brad Smith.
1980. Pulpwood production in the north central region by county, 1978. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-50, 23 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

Discusses 1978 production and receipts and recent production for other years in the Lake and Central States. Shows Michigan, Minnesota, and Wisconsin production by species for each county and compares production by Forest Survey Unit with that of previous years. Presents 1978 production and receipts data for Illinois, Indiana, Iowa, and Missouri, and shows four production classes by county.

KEY WORDS: roundwood, residue, receipts, Lake States, Central States.


Shhhh...
noise pollutes,
too!